This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

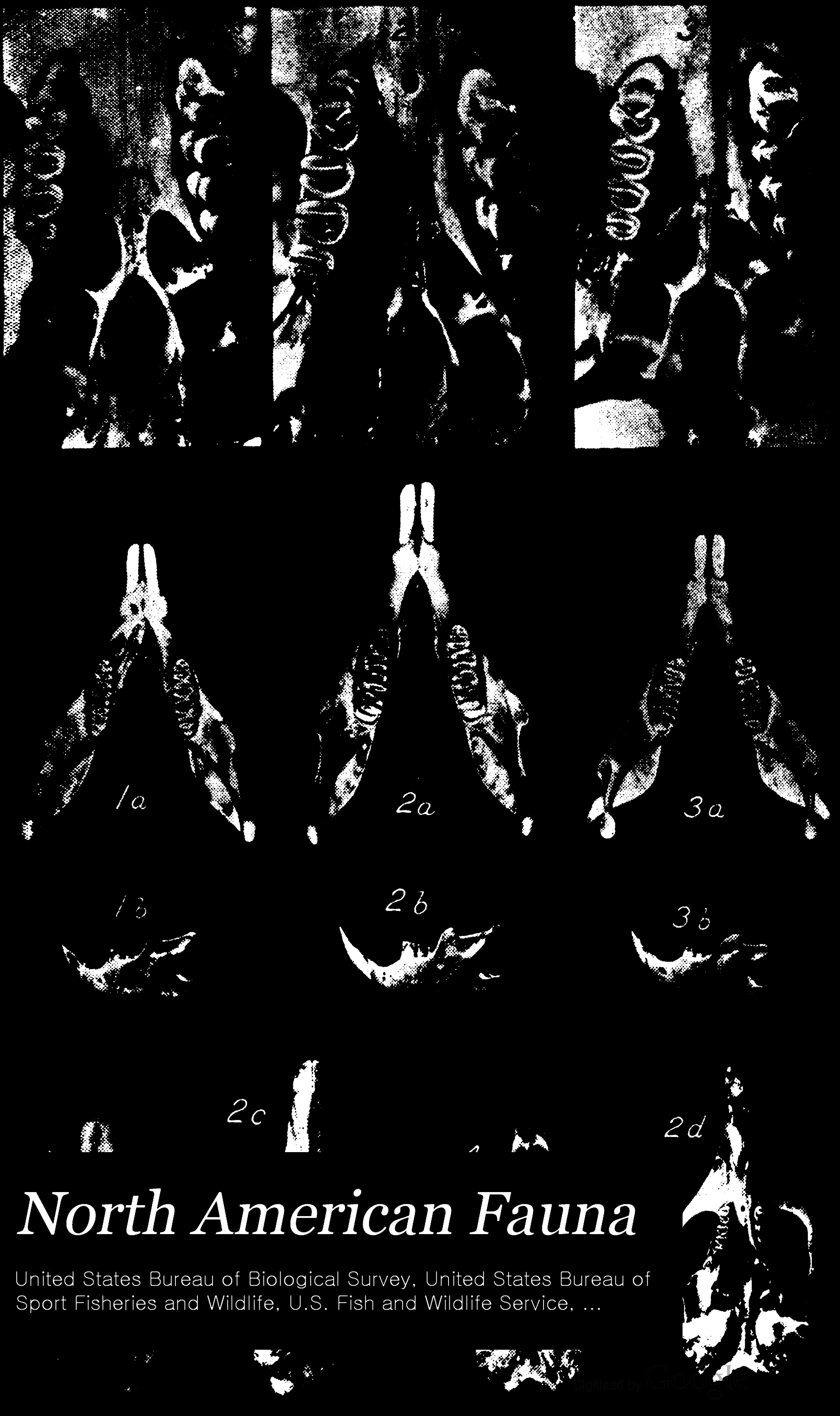
Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`



North American Fauna

United States Bureau of Biological Survey, United States Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, ...

SIGILLVM · VNIVERSITATIS · CALIFORNIENSIS
FIAT LVX
MDCCCLXVIII
EX LIBRIS

PALEO.
LIBRARY

EARTH
SCIENCES
LIBRARY

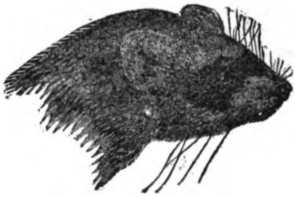
LIBRARY OF
~~DEPARTMENT OF ZOOLOGY~~
UNIVERSITY OF CALIFORNIA

U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF BIOLOGICAL SURVEY
HENRY W. HENSHAW, *Chief*

NORTH AMERICAN FAUNA

No. 34

[Actual date of publication, September 7, 1911]



REVISION OF THE SPINY POCKET MICE

(Genera HETEROMYS and LIOMYS)

BY

EDWARD A. GOLDMAN
FIELD NATURALIST, BIOLOGICAL SURVEY

WASHINGTON
GOVERNMENT PRINTING OFFICE
1911

QL151
U55

no. 34

~~BIOLOGY
LIBRARY~~
G

~~PALEO.
LIBRARY~~

EARTH
SCIENCES
LIBRARY

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Biological Survey,
Washington, D. C., April 15, 1911.

Sir: I have the honor to transmit herewith, for publication as North American Fauna No. 34, a Revision of the Spiny Pocket Mice (genera Heteromys and Liomys), by Edward A. Goldman, field naturalist, Biological Survey. The spiny pocket mice are widely distributed in the drier parts of North America, and, although of small size, are of considerable economic importance, owing to the fact that they feed chiefly on seeds, including weed seeds, corn, wheat, and beans. Comparatively little has been known of the relationships and distribution of these animals. Hence the need of the present revision, which brings the subject up to date and will materially lessen the labors of those who have occasion to study and identify the animals.

Respectfully,

Henry W. Henshaw,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

361891

CONTENTS.

Page.
Introduction 7
  History and material 7
  Habits and economic status 8
  Color and pelages 9
  Measurements 10
  Subgenera and minor groups 10
  List of species and subspecies, with type localities 11
  Key to genera and subgenera 12
  Key to species and subspecies 12
Genus *Heteromys* 14
Subgenus *Heteromys* 15
Subgenus *Xylomys* 30
Genus *Liomys* 32
Index 69

ILLUSTRATIONS.

PLATES.

Page.
PLATE I. Upper and lower molars (partially worn crowns) of *Heteromys desmarestianus*, *H. nelsoni*, and *Liomys i. alleni*. Jaws (lateral views) of *H. desmarestianus*, *H. nelsoni*, and *L. i. alleni*. Skulls (upper and lower views) of *H. anomalus* and *H. nelsoni* 64
II. Skulls (upper and lower views) of *Heteromys jesupi*, *H. australis*, *H. desmarestianus*, *H. longicaudatus*, *H. goldmani*, *H. fuscatus*, and *H. gaumeri* 66
III. Skulls (upper and lower views) of *Liomys pictus*, *L. p. parviceps*, *L. crispus*, *L. i. alleni*, *L. irroratus*, and *L. bulleri* 68

TEXT FIGURES.

FIG. 1. Distribution of *Heteromys anomalus*, *H. jesupi*, and *H. australis* 17
2. Distribution of *Heteromys desmarestianus* and allied forms 21
3. Distribution of *Heteromys* (*Xylomys*) *nelsoni* 31
4. Distribution of *Liomys pictus* and allied forms 34
5. Distribution of *Liomys crispus* and allied forms 46
6. Distribution of *Liomys irroratus* and allied forms 53

No. 34. NORTH AMERICAN FAUNA. Sept., 1911.

REVISION OF THE SPINY POCKET MICE.

(Genera Heteromys and Liomys.)

By Edward A. Goldman.

INTRODUCTION.

The spiny pocket mice of the genera *Heteromys* and *Liomys* belong to the family Heteromyidæ, a group of mammals widely distributed, especially in the drier parts of North America. The other members of the family are the pocket mice of the genus *Perognathus* and the kangaroo rats of the genera *Dipodomys*, *Perodipus*, and *Microdipodops*. Although of small size, these rodents are of considerable economic importance in many regions, owing to their excessive numbers and their habit of feeding on grain and other seed, which they carry off in their cheek pouches.

In *Heteromys* and *Liomys* the pelage is composed mainly of flattened and grooved bristles or spines, which readily distinguish these genera from all the others. The genus *Liomys*, with numerous forms, overlaps the other Heteromyidæ in geographic range, but gradually replaces them from southern Texas southward through Mexico. The genus *Heteromys* includes an austral group of species, some of which range in northern South America.

HISTORY AND MATERIAL.

A species of *Heteromys* was first described and figured under the name *Mus anomalus*, from the island of Trinidad, by John Vaughn Thompson.[1] In a paper read March 3, 1812, before the Linnæan Society of London he gave an excellent description, which was published in the Transactions of the Society three years later. Thompson was well aware of the peculiar characters of the animal, and regarded it as an anomaly serving as a connecting link between *Mus* and *Hystrix*, but hardly worthy of generic separation. In 1817 Desmarest proposed provisionally the generic name *Heteromys*, with *Mus anomalus* Thompson as type.[1]

---

[1] Trans. Linn. Soc. Lond., XI, pp. 161-163, pl. 10, 1815.

Five years later he was still somewhat doubtful of the applicability of the generic name *Heteromys*,[2] and placed *Mus anomalus* under *Cricetus anomalus*, the name he had applied to the animal in 1817. Lesson found it advantageous to separate *Heteromys* from *Cricetus* and used the name *Heteromys thompsonii* for *Mus anomalus*.

In 1843 Dr. J. E. Gray[3] referred to a specimen from Coban, Guatemala, which he named *Heteromys desmarestiana* but did not describe. This nomen nudum became a valid name in 1868, when Dr. Gray published his Synopsis of the Species of Saccomyinæ, or Pouched Mice, in the Collection of the British Museum. In this paper six species of *Heteromys* were recognized, four being added to the already named *H. anomalus* and *H. desmarestianus*. A few others were described at intervals, and in 1893 the species were first divided by Thomas[4] into groups based on characters presented by the soles of the hind feet, whether naked or hairy posteriorly and five- or six-tuberculate. These characters were also used by Allen[5] in tabulating a revised list of species in 1897. Meanwhile a large collection was accumulated by the Biological Survey; and in a paper published in 1902 Merriam added 20 new species and subspecies to the general group, more than doubling the number then known. Fifteen of the new forms were placed in a new genus, *Liomys*, and one was assigned to a new subgenus, *Xylomys*.

The present revision is the result of a study of the spiny pocket mice in the collection of the Biological Survey, now numbering nearly 1,000 specimens, supplemented by about 130 in the United States National Museum and from various sources. For the use of types and topotypes in other American collections acknowledgments are due to Dr. J. A. Allen, American Museum of Natural History; to Mr. Outram Bangs, Museum of Comparative Zoology; and to Dr. D. G. Elliot, Field Museum of Natural History. In addition I am indebted to Mr. Gerrit S. Miller, jr., for notes and comparison of specimens with the types in European museums.

HABITS AND ECONOMIC STATUS.

The habits of all the spiny pocket mice, so far as known, are very similar, but modified to a certain extent by the varying conditions of local environment. Like many other small rodents, they are nocturnal and so shy that their presence in large numbers is readily overlooked. They inhabit widely differing faunal areas, but everywhere burrow in the ground under bushes, trees, rocks, logs, or other shelter, and generally are most numerous in such cover along the borders of fields. The entrances to the burrows are inconspicuous, opening, as they commonly do, under thick beds of leaves, logs, or rocks; small quantities of earth are thrown out about them from time to time, but not usually forming a definite mound. These pocket mice reach their greatest abundance in semiarid, partially wooded regions, both plains and mountain slopes being well populated with them. Some species of *Heteromys*, however, inhabit humid heavily forested areas apparently throughout middle America. From three to five young are produced at a birth, four being the usual number. While the young seem more numerous in spring and early summer than at other times, it is evident that the animals breed throughout the year.

---

[1] Nouv. Dict. Hist. Nat., XIV, pp. 180-181, 455, 1817.

[2] Mammalogie, II, pp. 313-314, 1822.

[3] Proc. Zool. Soc. Lond., p. 79, 1843.

[4] Ann. Mag. Nat. Hist., ser. 6, XI, pp. 329-330, April, 1893.

[5] Bull. Amer. Mus. Nat. Hist., IX, p. 57, March 15, 1897.

The food of the spiny pocket mice consists largely of seeds. These are of great variety and include seeds of weeds and many composite plants, corn and wheat, beans and castor beans, supplemented by fragments of green leaves and short sections of twigs. Individuals taken in the vicinity of fields frequently have the cheek pouches filled with grain. Thompson relates in his description of *H. anomalus* that in the island of Trinidad "they do incalculable mischief in farms and granaries; for, not satisfied with what they can eat on the spot, they stow away and carry off in their cheek pouches no inconsiderable quantity [of grain] to be deposited in their retreats for times when food is not to be procured from without." While apparently not so injurious to crops as some other rodents, these mice, in some places, are among the most numerous of the small mammals, and their food habits, as well as those of the great family to which they belong, should be better known.

COLOR AND PELAGES.

Color variation in the group as a whole is considerable, but certain shades, mainly grays, extend with slight modification through assemblages of related species. The general color of the upperparts depends largely on that of the tips of the spiny element in the pelage; the tips range from light gray to black. The slender hairs interspersed among the spines and often reaching beyond them vary from plain gray to rich orange buff, and may or may not greatly alter the general tone. The general color may be affected also by climatic conditions or a forested environment. The forms inhabiting heavily wooded areas are usually darker than those which live in more open or semidesert situations. An ochraceous or orange buffy lateral line is present in some species and absent in others. The underparts are white.

The pelage of the young at birth consists of fine hairs and flattened, anteriorly grooved bristles, which are quite soft. This juvenal coat is replaced in most species by the spiny adult pelage when the animals are one-half to three-fourths grown; in *H. nelsoni* and perhaps in *H. bicolor* the juvenal coat is permanent. The adult pelage usually appears first in spots on the head and near the middle of the back, gradually spreading with a sharp line of demarcation until the entire body is covered. The molting season is very irregular, partly owing to the prolongation of the breeding period through the entire year. As a rule the adults are at the molting stage in early summer, but fully grown individuals in worn and fresh pelages may be seen together at almost any time. In some species the new coat seems to replace the old almost imperceptibly; in others it appears first on the head, passing progressively backward. Occasionally an irregular patched appearance results, or the change may resemble that which takes place when the adult pelage is acquired. During wear the slender hairs are abraded and the spines thus more exposed give the animal a somewhat darker color than when in the fresh coat.

MEASUREMENTS.

All measurements of specimens, unless otherwise stated, are in millimeters. With a few exceptions, usually stated, the external measurements were taken in the flesh by the collector, as follows: *Total length* (nose to end of terminal tail vertebra); *tail vertebræ* (upper base of tail to end of terminal tail vertebra); *hind foot* (heel to end of longest claw). While adult males average slightly larger than females, the difference is scarcely appreciable in the small series usually available. The external and cranial measurements given are, therefore, of series which may include specimens of both sexes. The following cranial measurements have been taken:

Greatest length.—The length from the tip of the nasals to the supraoccipital in the median line over the foramen magnum.

Zygomatic breadth.—The greatest distance across the zygomata.

Interorbital breadth.—The least distance between the orbits.

Length of nasals.—The greatest length of the nasals.

Width of braincase.—The distance between the outer sides of the squamosals immediately in front of the projection of the auditory meatus.

Alveolar length of upper molar series.—The greatest length of the upper molariform tooth row, at the alveolar border.

SUBGENERA AND MINOR GROUPS.

The genus *Heteromys* has been divided into two subgenera. *Heteromys*, the typical subgenus, contains all the species except *H. nel-*

soni, which is placed in the monotypic subgenus *Xylomys*. The latter is distinguished externally by large size and by the softness of its pelage. The genus *Liomys* is undivided subgenerically, but may be separated into three well-defined groups: the *irroratus* group, with light grayish coloration and five-tuberculate soles of hind feet; the *pictus* group, characterized by rich orange rufous lateral lines and six-tuberculate soles of hind feet; and the *crispus* group, including small species with short tails, plain coloration, and peculiar dental characters.

In the present revision 14 species and subspecies are assigned to the genus *Heteromys* and 28 to the genus *Liomys*, of which one species of *Heteromys* and two forms of *Liomys* are characterized for the first time.

List of Species and Subspecies, with Type Localities.

Genus HETEROMYS.

H. anomalus group:	
Heteromys anomalus (Thompson)	Island of Trinidad, West Indies.
jesupi Allen	Near Minca, Santa Marta District, Colombia.
australis Thomas	San Javier, lower Cachabi River, Ecuador.
bicolor (Gray)[1]	Venezuela.
H. desmarestianus group:	
Heteromys desmarestianus Gray	Coban, Guatemala.
desmarestianus griseus Merriam	Mountains near Tonala, Chiapas, Mexico.
longicaudatus Gray	"Mexico."
goldmani Merriam	Chicharras, Chiapas, Mexico.
lepturus Merriam	Mountains near Santo Domingo, Oaxaca.
temporalis sp. nov	Motzorongo, Vera Cruz, Mexico.
repens Bangs	Boquete, Volcan de Chiriqui, Panama.
fuscatus Allen	Tuma, Nicaragua.
gaumeri Allen and Chapman	Chichen Itza, Yucatan.

Subgenus XYLOMYS.

Heteromys nelsoni Merriam	Pinabete, Chiapas, Mexico.

Genus LIOMYS.

L. pictus group:	
Liomys pictus (Thomas)	Mineral San Sebastian, Jalisco.
pictus escuinapæ (Allen)	Escuinapa, Sinaloa, Mexico.
pictus sonorana Merriam	Alamos, Sonora, Mexico.
pictus plantinarensis Merriam	Plantinar, Jalisco, Mexico.
pictus parviceps Goldman	La Salada, Michoacan, Mexico.
pictus rostratus Merriam	Near Ometepec, Guerrero, Mexico.
pictus phæurus Merriam	Pinotepa, Oaxaca, Mexico.
pictus isthmius Merriam	Tehuantepec, Oaxaca, Mexico.
pictus veræcrucis Merriam	San Andres Tuxtla, Vera Cruz, Mexico.
pictus obscurus Merriam	Carrizal, Vera Cruz, Mexico.
annectens (Merriam)	Pluma, Oaxaca, Mexico.

---

[1] *Heteromys bicolor* may not belong here.

L. crispus group:

Liomys crispus Merriam	Tonala, Chiapas, Mexico.
crispus setosus Merriam	Huehuetan, Chiapas, Mexico.
vulcani (Allen)	Volcan de Chinandega, Nicaragua.
heterothrix Merriam	San Pedro Sula, Honduras.
salvini (Thomas)	Dueñas, Guatemala.
salvini nigrescens (Thomas)	"Costa Rica."
adspersus (Peters)	"Panama."

L. irroratus group:

Liomys irroratus (Gray)	"Mexico, State of Oaxaca."
irroratus torridus Merriam	Cuicatlan, Oaxaca, Mexico.
irroratus minor Merriam	Huajuapam, Oaxaca, Mexico.
irroratus alleni (Coues)	Rio Verde, San Luis Potosi, Mexico.
irroratus pretiosus subsp. nov	Metlaltoyuca, Puebla, Mexico.
irroratus texensis Merriam	Brownsville, Texas.
irroratus canus Merriam	Near Parral, Chihuahua, Mexico.
irroratus jalicensis (Allen)	Las Canoas, 20 miles west of Zapotlan, Jalisco, Mexico.
bulleri (Thomas)	La Laguna, Sierra de Juanacatlan, Jalisco, Mexico.
guerrerensis sp. nov	Omilteme, Guerrero, Mexico.

Key to Genera and Subgenera.

a. Posterior molars narrower than premolars.

  b. Posterior loop in crown of upper premolar with a deep reentrant angle directed inward and backward from anterior border; interpterygoid fossa narrowing gradually to a rather acute point anteriorly........................*Heteromys*.

  b'. Posterior loop in crown of upper premolar with anterior border concave; interpterygoid fossa broad and rounded anteriorly........................*Liomys*.

a'. Posterior molars equal to or broader than premolars....................*Xylomys*.

Key to Species and Subspecies.

[Based on typical adults.]

I. Subgenus HETEROMYS.

a. Pelage composed of bristles mingled with slender hairs.

  b. Sole of hind foot naked posteriorly.

    c. Parietals reaching laterally across temporal ridges.

      d. Inner side of forearm clouded with dusky.

        e. Tail more than 150; slender hairs on dorsum dull ochraceous buffy. (Venezuela; Island of Trinidad.)........................*H. anomalus* (p. 16)

        e'. Tail less than 140; slender hairs on dorsum clear grayish. (Ecuador.) *H. australis* (p. 18)

      d'. Inner side of forearm white.

        e. Outer sides of frontals widely overhanging orbits. (Mexico to Panama.)

          f. Buffy lateral line present.

            g. Ankles white above.

              h. Nasals moderately broad anteriorly, narrowing gradually near middle.

                i. Back blackish. (West-central Guatemala; Chiapas, north of Sierra Madre; mountains of southern Tabasco.) *H. desmarestianus* (p. 20)

                i'. Back grayish. (Western Chiapas; eastern Oaxaca.) *H. d. griseus* (p. 22)

h'. Nasals very broad anteriorly, narrowing abruptly near middle. (Lowlands of Tabasco.)..................*H. longicaudatus* (p. 23)
g'. Ankles dusky all round. (Eastern Oaxaca and southern Vera Cruz.) *H. lepturus* (p. 25)
f'. Buffy lateral line absent.
g. Hind foot less than 35.
h. Nasals reaching posteriorly beyond premaxillæ. (Panama.) *H. repens* (p. 27)
h'. Nasals not reaching posteriorly beyond premaxillæ. (Nicaragua.) *H. fuscatus* (p. 28)
g'. Hind foot more than 37. (Southern Chiapas.)..*H. goldmani* (p. 24)
e'. Outer sides of frontals narrowly overhanging orbits. (Colombia.) *H. jesupi* (p. 18)
c'. Parietals not reaching laterally across temporal ridges. (Vera Cruz.) *H. temporalis* (p. 26)
b'. Sole of hind foot hairy from near posterior tubercle to heel. (Yucatan; Campeche.)..*H. gaumeri* (p. 29)
a'. "Fur somewhat harsh but not in the least bristly." (Venezuela.) *H. bicolor* (p. 19)

II. Subgenus XYLOMYS (monotypic).

III. Genus LIOMYS.

[Based on typical adults.]

a. Sole of hind foot five-tuberculate (*irroratus* group).
b. Back mainly mouse gray.
c. Interparietal suboval.
d. Nasals normally truncate posteriorly.
e. Hind foot more than 30.
f. Anterior nares not much inflated.
g. Paler; hind foot usually more than 33. (Southern Chihuahua; Durango; northwestern Zacatecas.)...............*L. i. canus* (p. 60)
g'. Darker; hind foot usually 32 or less.............*L. i. alleni* (p. 56)
f'. Anterior nares much inflated. (Tropical lowlands in northern Vera Cruz, Puebla, Queretaro, and eastern San Luis Potosi.) *L. i. pretiosus* (p. 58)
e'. Hind foot usually less than 30.
f. Hind foot 28 or more.
g. Interparietal more than twice as wide as long. (Central Jalisco; northwestern Michoacan.).......................*L. i. jalicensis* (p. 60)
g'. Interparietal less than twice as wide as long. (Southern Texas; Tamaulipas; eastern Nuevo Leon.)..........*L. i. texensis* (p. 59)
f'. Hind foot less than 28. (Northwestern Oaxaca; northeastern Guerrero.) *L. i. minor* (p. 56)
d'. Nasals normally emarginate posteriorly. (Known ranges south of 19° north latitude.)
e. Hind foot more than 30. (Central and eastern Oaxaca.) *L. irroratus* (p. 53)
e'. Hind foot less than 30. (Northern Oaxaca; southern Puebla; Morelos; eastern Guerrero.)...............................*L. i. torridus* (p. 55)
c'. Interparietal subtriangular. (Sierra de Juanacatlan, Jalisco.) *L. bulleri* (p. 61)
b'. Back deep glossy black. (Mountains of central Guerrero.) *L. guerrerensis* (p. 62)

a'. Sole of hind foot normally six-tuberculate (*pictus* and *crispus* groups).
b. Orange buffy lateral line present (*pictus* group).
c. Hind foot not more than 30.
d. Hind foot more than 25.
e. Tail whitish below to near tip.
f. Ground color of back grayish. (Pacific slope.)
g. Interparietal subtriangular.
h. Nasals emarginate posteriorly.
i. Forearm normally edged with gray or buffy along outer side.
j. Ground color of upperparts paler gray. (Southern Sinaloa and Tepic.)..............................*L. p. escuinapæ* (p. 35)
j'. Ground color of upperparts darker gray. (Western and southern Jalisco; northwestern Michoacan.) *L. p. plantinarensis* (p. 37)
i'. Forearm entirely white..................*L. p. isthmius* (p. 41)
h'. Nasals truncate posteriorly....................*L. pictus* (p. 33)
g'. Interparietal suboval.........................*L. p. rostratus* (p. 39)
f'. Ground color of back blackish. (Atlantic slope of Isthmus of Tehuantepec.)..................................*L. p. veraecrucis* (p. 42)
e'. Tail dark all round on terminal half..............*L. p. phaeurus* (p. 40)
d'. Hind foot less than 25...........................*L. p. parviceps* (p. 38)
c'. Hind foot more than 30.
d. Hind foot less than 32.
e. Back blackish. (South-central Vera Cruz from the Papaloapam Valley to near Jalapa.)..................................*L. p. obscurus* (p. 44)
e'. Back grayish. (Southern Sonora; northern Sinaloa; southwestern Chihuahua; western Durango.)....................*L. p. sonorana* (p. 36)
d'. Hind foot 32 or more. (Sierra Madre of Guerrero and southwestern Oaxaca.) *L. annectens* (p. 45)
b'. Orange buffy lateral line absent (*crispus* group).
c. Sole of hind foot hairy posteriorly.
d. Known ranges in Mexico.
e. Color paler; skull smaller. (Western Chiapas.).....*L. crispus* (p. 46)
e'. Color darker; skull larger. (Southern Chiapas.)....*L. c. setosus* (p. 47)
d'. Known ranges in Central America.
e. Upperparts not distinctly buffy.
f. Forearm edged with slaty gray.
g. Color paler. (Guatemala.)........................*L. salvini* (p. 50)
g'. Color darker. (Costa Rica.).................*L. s. nigrescens* (p. 51)
f'. Forearm nearly or entirely pure white. (Nicaragua.) *L. vulcani* (p. 48)
e'. Upperparts distinctly buffy. (Honduras.).........*L. heterothrix* (p. 49)
c. Sole of hind foot naked posteriorly. (Panama.)..........*L. adspersus* (p. 51)

Genus HETEROMYS Desmarest.

Heteromys Desmarest, Nouv. Dict. Hist. Nat., XIV, pp. 180–181, 455, 1817. Type *Mus anomalus* Thompson.
Saccomys F. Cuvier, Mem. Mus. Hist. Nat., Paris, X, pp. 419–428, Pl. XXVI, 1823.
Dasynotus Wagler, Nat. Syst. Amphib., p. 21, 1830.

Generic characters.—Pelage composed of flattened, anteriorly grooved bristles or spines (except possibly in *H. bicolor*), mingled with slender hairs; tail usually longer than head and body, not conspicuously crested or penciled at tip; sole of hind foot five- or six-tuberculate, naked at least to posterior tubercle. Skull elongated; mastoids rather small, appearing externally entirely posterior to auditory meatus; audital bullæ not overlapped by pterygoids; interpterygoid fossa V-shaped, narrowing gradually to a rather acute point anteriorly. Front of upper incisors without grooves; molariform teeth, except lower premolar, with three more or less distinct roots, the two posterior in the upper premolar usually fused in some species; lower premolar with two roots. Molar crowns in early life completely divided by a transverse sulcus into two parallel enamel loops, the grinding surface becoming flat, and the loops uniting first at inner ends of upper row and outer ends of lower row, and continued wear obliterating sulcus or leaving a central enamel island.

Subgenus **HETEROMYS** Desmarest.

Type.—*Mus anomalus* Thompson, from Trinidad, West Indies.

Distribution.—Tropical or subtropical portions of continental America from southern Mexico to Ecuador, also Island of Trinidad, West Indies.

Subgeneric characters.—Pelage hispid (except possibly in *H. bicolor*); tail thinly haired; hind foot naked posteriorly (except in *gaumeri*), six-tuberculate; inner sides of forearms pure white or clouded with dusky. Braincase rather flat; temporal ridges usually distinct; upper surface of maxillary root of zygoma triangular; parietals not reaching laterally along lambdoid crest to mastoids; angle of mandible moderately everted. Last molars slightly narrower than premolars; tubercle over root of lower incisor small; permanent upper premolar with anterior border of posterior loop infolded, the fold forming normally a deep reentrant angle directed inward and backward; additional enamel islands present in early life in posterior loops of upper molars and anterior loops of lower molars, but disappearing with advancing age.

Remarks.—In the genera *Heteromys* and *Liomys* the size of the tubercles over roots of lower incisors is correlated with the size of the last lower molars, that is, when the tubercles are large the molars are small and vice versa. The maximum development of the tubercles is reached in the genus *Liomys* and the minimum in the subgenus *Xylomys*. The intermediate position of the typical subgenus is shown by a more evenly balanced condition of these tubercles and molars and the possession of other characters which are more pronounced in *Liomys* and *Xylomys* or shared with only one of them.

The type species of the subgenus and nearly related South American forms seem to show a closer approach to *Liomys* in early obliteration of additional enamel islands in the loops of molariform teeth than do most Central American and Mexican species, which in this respect are rather more like *Xylomys*. *H. gaumeri* differs from all other known members of the genus and agrees with *Liomys* in having the soles of hind feet hairy posteriorly. Relationship to *Liomys* is suggested also by the early disappearance of additional enamel islands in the loops of molariform teeth; but the characters which readily separate *Heteromys* from *Liomys* in the adult state—the more tapering and anteriorly sharply excised interpterygoid fossa and deep reentrant angle in posterior loop of upper premolar, together with other cranial details—place *gaumeri* in the typical genus.

HETEROMYS ANOMALUS GROUP.

HETEROMYS ANOMALUS (Thompson).

TRINIDAD SPINY POCKET MOUSE.

(Pl. I, figs. 4, 4*a*.)

Mus anomalus Thompson, Trans. Linn. Soc. Lond., XI, pp. 161–163, pl. 10, 1815.
Cricetus anomalus Desmarest, Nouv. Dict. Hist. Nat., XIV, p. 180, 1817; Mammalogie, pt. 2, pp. 313–314, 1822.
Heteromys thompsonii Lesson, Manuel de Mammalogie, p. 264, 1827.
Heteromys anomalus Gray, Proc. Zool. Soc. Lond., p. 203, 1868.
Heteromys melanoleucus Gray, Ibid., p. 204, 1868. From Venezuela (not Honduras).[1] Type in Brit. Mus.

Type locality.—Island of Trinidad, West Indies.

Distribution.—Island of Trinidad and Venezuela.

General characters.—Size medium for subgenus *Heteromys;* tail longer than head and body, thinly haired, sharply bicolored; buffy lateral line absent; sole of hind foot naked, six-tuberculate. Related to *H. jesupi*, but darker; inner sides of forearms more or less clouded with dusky, instead of white, as in *jesupi*.

Color.—*Fresh pelage:* Upperparts dark mouse gray, mixed with blackish on median dorsal area, faintly grizzled with dull buffy hairs; underparts and feet white; outer sides of legs, sometimes including forearms all around, mouse gray; grayish of hind legs becoming blackish on sides of ankles, leaving heels whitish; ears dusky, without white edging; tail brownish above, whitish below, usually more or less mottled with brownish.

Cranial characters.—Skull medium in size for a *Heteromys*, with heavy flattened rostrum and narrow braincase; anterior nares much inflated; nasals very broad, truncate posteriorly; premaxillæ broad posteriorly, usually reaching beyond nasals; frontals narrow; supraorbital and temporal ridges weakly developed; sagittal area narrow; interparietal pointed elliptical; interpterygoid fossa narrow anteriorly; palatopterygoids slender; audital bullæ small; angle of mandible short, heavy, only slightly everted; tubercle over root of lower incisor small; mandibular toothrow relatively rather broad posteriorly; posterior lobe of upper premolar with anterior border deeply infolded; additional enamel islands in posterior lobes of upper molars disappearing through wear rather early in life. Similar in size and general form to *H. jesupi;* nasals broader posteriorly, squarely truncate, instead of convex or acuminate; premaxillæ reaching posteriorly beyond nasals (exceeded by nasals in *jesupi*); palate narrower.

---

[1] See Alston, Biol. Cent.-Amer. Mamm., p. 167; Ann. Mag. Nat. Hist., ser. 5, VI, pp. 118–119, 1880.

Measurements.—Average of five adults from Caura, Island of Trinidad: Total length, 286 (280–298); tail vertebræ, 158 (153–163); hind foot, 34.8 (34–36). *Skull* (average of same): Greatest length, 35 (34.1–36.3); zygomatic breadth, 16 (15.8–16.3); interorbital breadth, 8.3 (7.8–8.5); length of nasals, 13.8 (13.3–14.7); width of braincase, 14.7 (14.5–14.9); alveolar length of upper molar series, 5.2 (5–5.6).

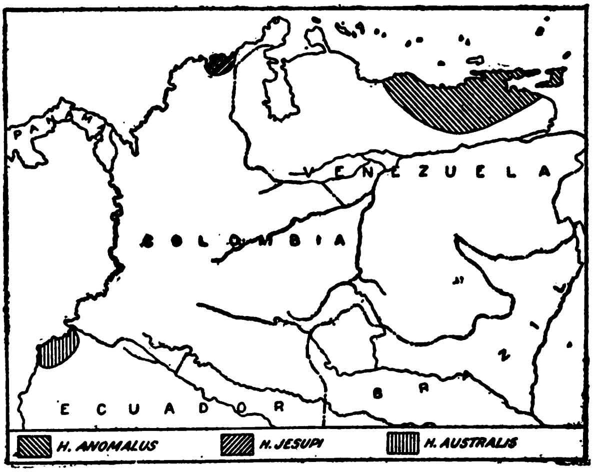


FIG. 1.—Distribution of *Heteromys anomalus*, *H. jesupi*, and *H. australis.*

Remarks.—*H. anomalus*, the type species of the genus, presents less extreme development in cranial characters than is exhibited in some North American species; the broad supraorbital shelves of such forms as *desmarestianus*, *lepturus*, and *goldmani* are represented by slight, narrow ridges, and the additional enamel islands in the posterior lobes of upper molars disappear through wear somewhat earlier in life in *anomalus.* In general characters *anomalus* agrees in many respects with *jesupi* and the two are evidently not very distantly related.

Ten specimens, including a number of perfect skulls of adults with imperfect skins from Los Palmales, San Julian, Macuto, and Quebrada Seca, in northern Venezuela, assumed to be like "*melanoleucus,*" do not seem separable from typical *anomalus.*

Specimens examined.—Total number 26, from the following localities:

Trinidad: Caparo, 3; Caura, 11; Princestown, 2.
Venezuela: Los Palmales, 5; Macuto, 1; San Julian, 3; Quebrada Seca, 1.

HETEROMYS JESUPI Allen.

JESUP SPINY POCKET MOUSE.

(Pl. II, figs. 1, 1*a*.)

Heteromys jesupi Allen, Bull. Amer. Mus. Nat. Hist., XII, pp. 201–202, Dec. 20, 1899.

Type locality.—Near Minca, Santa Marta district, Colombia (altitude 1,000 feet). Type No. 15347, ♀ adult, American Museum of Natural History, collected by H. H. Smith, July 30, 1899.

Distribution.—Mountain slopes of the Santa Marta district in northern Colombia.

General characters.—Similar to *H. anomalus*, but paler; inner sides of forearms white, instead of clouded with dusky; buffy lateral line absent, and hind foot naked and six-tuberculate, as in *anomalus*.

Color.—*Fresh pelage:* Upperparts mouse gray, mixed with blackish on median dorsal area, thinly grizzled with ochraceous buffy hairs; outer sides of legs pale mouse gray, this color becoming darker and reaching down over sides of ankles, usually including heels; ears dusky without distinct white edging; tail brownish above, dull whitish below.

Cranial characters.—Skull much like that of *H. anomalus;* nasals narrower posteriorly, convex or acuminate instead of truncate; premaxillæ not reaching beyond posterior plane of nasals (passing this plane in *anomalus*); interparietal with a small posterior, median notch (absent in *anomalus*); palate broader.

Measurements.—Type (from original description): Total length, 330; tail vertebræ, 163; hind foot, 33. Average of six females: 292; 160; 34. *Skull* (average of two adults): Greatest length, 35.6 (35.2–36.1); zygomatic breadth, 16.4 (16.4–16.5); interorbital breadth, 8.3 (8.2–8.5); length of nasals, 14.8 (14.4–15.2); width of braincase, 14.9 (14.9–15); alveolar length of upper molar series, 5.5 (5.5–5.6).

Remarks.—This species is evidently rather nearly related to the type species of the genus *H. anomalus* of Trinidad and northern Venezuela.

Specimens examined.—Total number 8, from the following localities:

Colombia: Minca, 3 (including type); Bonda, 1; El Libano Plantation, 1; Mamatoca, 1; Masinga Vieja, 1; Onaca, 1.

HETEROMYS AUSTRALIS Thomas.

SOUTHERN SPINY POCKET MOUSE.

(Pl. II, figs. 2, 2*a*.)

Heteromys australis Thomas, Ann. Mag. Nat. Hist., ser. 7, VII, p. 192, Feb., 1901.

Type locality.—San Javier, lower Cachabi River, Ecuador (altitude 65 feet). Type, ♀, collected by G. Flemming and R. Miketta, June 23, 1900.

Distribution.—Known only from the type locality, near the Pacific coast in extreme northern Ecuador.

General characters.—Size medium, tail about equal to head and body, thinly haired, nearly unicolor; pelage very short and hispid; color dark; feet clouded with dusky; sole of hind foot naked, six-tuberculate. Somewhat like *jesupi* and *repens* externally, but smaller and darker and not closely related.

Color.—*Fresh pelage:* Upperparts varying from very dark mouse gray to blackish slate, darkest on median dorsal area, finely and inconspicuously grizzled with slender grayish hairs; outer sides of legs blackish; forearms, ankles, and base of tail more or less black all round; fore and hind feet dull whitish, clouded with black; ears dusky, without white edging; tail brownish black above, slightly paler below.

Cranial characters.—Skull rather short and broad, with large inflated braincase, short, heavy rostrum, anteriorly spreading zygomata, and very small audital bullæ. In general form somewhat similar to that of *jesupi*, but smaller; braincase more fully inflated; parietal bulging noticeably, leaving a narrow median depression between them, not much prolonged laterally along lambdoid suture; frontal and sagittal areas broader; premaxillæ narrower posteriorly, more nearly conterminous with nasals (nasals usually reaching beyond premaxillæ in *jesupi*); zygomata more squarely and relatively more widely spreading anteriorly; palate with a distinct ridge along median line between premolars; bullæ much smaller, more angular, and tapering antero-internally; dentition about as in *jesupi*.

Measurements.—Type (from original description): Head and body, 135; tail, 137; hind foot, 33. Average of four adult topotypes: 128; 128; 30 (hind foot without claw?). *Skull* (average of three adults): Greatest length, 33.6 (33.2–34.1); zygomatic breadth, 16.2 (16–16.3); interorbital breadth, 8.6 (8.3–8.9); length of nasals, 13.2 (12.8–13.7); width of braincase, 14.7 (14.5–14.9); alveolar length of upper molar series, 5.1 (5–5.1).

Remarks.—*H. australis* is a strongly marked species apparently nearer in cranial characters to *jesupi* and *anomalus* than to *repens*, but not requiring close comparison with either. No other member of the genus is known to range so far south.

Specimens examined:

Ecuador: San Javier (type locality), 4.

HETEROMYS BICOLOR (Gray).

BICOLORED SPINY POCKET MOUSE.

Perognathus bicolor Gray, Proc. Zool. Soc. Lond., 202, 1868.
Heteromys bicolor Alston, Ann. Mag. Nat. Hist., VI, pp. 118–119, 1880.

Type locality.—Venezuela (not "Honduras").[1] Type in British Museum, sent by Dyson from Venezuela.

Distribution.—Range unknown.

---

[1] Ann. Mag. Nat. Hist. VI, 118-119, 1880.

General characters.—(Amended description by Alston.)[1] "Ears with the notch apparently bounded by two lobes; tail clad with short, fine, stiffish hairs; fur rather long, sparse, with no under-fur, somewhat harsh, but not in the least bristly. Color above uniform dark brown, which extends to the outside of the limbs; feet dusky, edges of cheek-pouches and all the lower parts white, the hairs all uniform in color throughout their length. Approximate measurements (of the mounted specimen)—length of head and body about 3.75 inches, of tail 3 inches, of hind foot 1 inch."

Remarks.—In describing *Perognathus bicolor* (=*Heteromys bicolor*), Gray seems to have confused his type with some other specimen, as shown by Alston; hence Alston's amended description is here substituted for the original one. The type of *bicolor* has not been examined by me and may possibly prove to be generically separable from *Heteromys.*

HETEROMYS DESMARESTIANUS GROUP.

HETEROMYS DESMARESTIANUS Gray.

COBAN SPINY POCKET MOUSE.

(Pl. I, figs. 1, 1*a*, 1*b*; Pl. II, figs. 3, 3*a*.)

Heteromys desmarestianus Gray, Proc. Zool. Soc. Lond., p. 204, 1868.

Type locality.—Coban, Guatemala. Type in British Museum.

Distribution.—Mountainous portions of western Guatemala, also northern Chiapas and southern Tabasco, Mexico. Humid Tropical Zone.

General characters.—Size large; tail decidedly longer than head and body, scantily haired; color dark, decidedly darker than *longicaudatus,* but not so dark as *goldmani;* ochraceous buffy lateral line usually faint; ears without white edging; pelage coarse; sole of hind foot naked, six-tuberculate.

Color.—*Fresh pelage:* General color of upperparts between dark mouse gray and slaty black, usually darkest along median line from nose to base of tail, heavily and uniformly grizzled with slender ochraceous buffy hairs; ochraceous buffy lateral line from cheeks to hind legs, distinct in some specimens, almost imperceptible in others; underparts and feet white, this color extending down in a continuous line along inner sides of hind legs; ears thinly covered with short dusky hairs, overlapped anteriorly by a tuft of long blackish bristles; outer sides of forelegs mouse gray tinged with ochraceous buffy, merging above with general color of upperparts; sides of ankles, and sometimes heels, dusky; tail dusky above, whitish below on basal two-thirds, darkening gradually toward tip, which is usually dusky all round.

---

[1] Ann. Mag. Nat. Hist., VI, 119, 1880.

Cranial characters.—Skull large—about equal to *longicaudatus* and *lepturus*—high and well arched along median line above, with narrow rostrum, nasals, and interparietal, broad frontals and premaxillæ. In general form much like that of *longicaudatus*, but rostrum narrower, broadening more abruptly to zygomata; nasals less expanded near middle; upper surface of maxillary root of zygomata shorter, less prolonged anteriorly; supraoccipital and temporal ridges strongly developed, shelving over orbits and curving posteriorly across parietals to lambdoid suture; interparietal varying from irregularly oval to pentagonal, the anterior angle prolonged; premaxillæ reaching posteriorly slightly beyond nasals; zygomata only slightly spreading anteriorly, the sides nearly parallel; palatopterygoids long and slender; interpterygoid fossa V-shaped, deeply excised anteriorly; bullæ small; angle of mandible slightly everted; tubercle over root of lower incisor moderately developed; molariform teeth rather small, as usual in the subgenus; posterior lobe of upper premolar with a deep reentrant enamel fold; posterior molars narrower than premolars above and below; additional enamel islands in posterior lobes of upper molariform teeth and anterior lobes of lower molariform teeth present in young, disappearing in anterior molars with advancing age, but persisting, at least in last upper molars, until extreme old age.

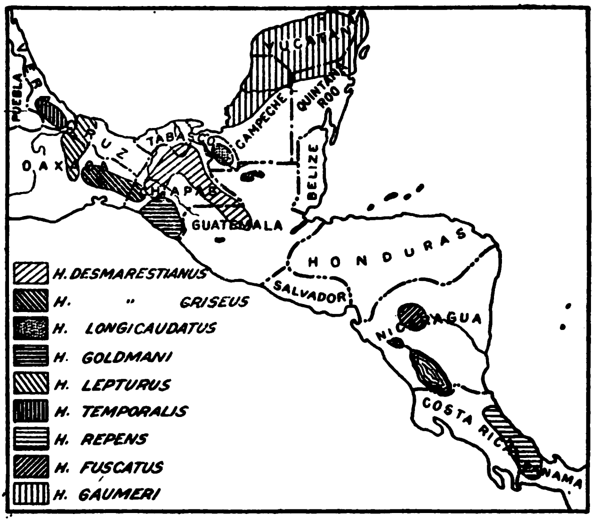


FIG. 2.—Distribution of *Heteromys desmarestianus* and allied forms.

Measurements.—Type:[1] Total length, 260; tail vertebræ, 123 (tip gone); hind foot, 35.4. Average of 5 adult males and females from Tumbala, Chiapas: 302 (272–323); 167 (139–180); 37.5 (37–38). *Skull* (average of 3 adults): Greatest length, 37.3 (37.2–37.4); zygomatic breadth, 16.6 (16.2–17); interorbital breadth, 9.8 (9.6–9.9); length of nasals, 15.1 (15–15.2); width of braincase, 15.5 (15.2–15.9); alveolar length of upper molar series, 5.2 (5–5.7).

---

[1] Measured by Gerrit S. Miller, Jr.

Remarks.—Mr. Gerrit S. Miller, jr., has compared for me specimens of all the large species of the genus known to occur in Mexico with the type of *desmarestianus.* Specimens from Tumbala, Chiapas, were found to agree very closely with it and are probably nearly typical. The species has a wider known range in Mexico than any other member of the genus, and the agreement in many important characters with *longicaudatus* suggests that the latter may prove to be a rather slightly differentiated offshoot of this more generalized type.

October specimens from Tumbala are in apparently fresh or only slightly worn pelage. Those taken in March and April at Teapa, Tabasco, are in molting condition, the change about complete in some, while others have a growing patch of fresh fur along median dorsal area, below which the sides are ragged and much worn.

Specimens examined.—Total number 17, from localities as follows:

Chiapas: Tumbala, 6; Ocuilapa, 3.
Tabasco: Teapa, 8.

HETEROMYS DESMARESTIANUS GRISEUS Merriam.

GRAY SPINY POCKET MOUSE.

Heteromys griseus Merriam, Proc. Biol. Soc. Wash., XV, p. 42, Mar. 5, 1902.

Type locality.—Mountains near Tonala, Chiapas, Mexico. Type No. 76062, ♂ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, August 15, 1895.

Distribution.—Mountains of western Chiapas and along the Isthmus of Tehuantepec in eastern Oaxaca. Humid Tropical Zone.

General characters.—Size and proportions similar to those of *desmarestianus;* color much grayer; sole of hind foot naked and six-tuberculate as in *desmarestianus.*

Color.—*Fresh pelage:* General color above mouse gray, palest along sides, thickly grizzled with slender ochraceous buffy hairs; buffy lateral line faint; feet and underparts white; outer sides of forearms grayish tinged with pale buff, interrupted across upper part of arms in some specimens by a white area, in others continuous with general color of upperparts; ears and ankles dusky; tail dusky above, whitish below except near end, which is dusky all round.

Cranial characters.—Skull closely resembling that of *desmarestianus,* but somewhat smaller; premaxillæ decidedly narrower and more tapering posteriorly; interparietal slightly shorter antero-posteriorly.

Measurements.—Type: Total length, 325; tail vertebræ, 186; hind foot, 38. Average of 3 adult topotypes: 317 (310–325); 181 (176–186); 37.2 (36–38). *Skull* (average of 4 adults): Greatest length, 36.2 (35.5–36.7); zygomatic breadth, 16.6 (16.1–17.2); interorbital breadth, 9.5 (9.3–9.8); length of nasals, 15.1 (14.5–15.5); width of braincase, 15.3 (14.9–15.7); alveolar length of upper molar series, 5.2 (5–5.2).

Remarks.—This is a paler form evidently closely related to *desmarestianus.* Specimens from Guichicovi, Oaxaca, are darker colored than typical *griseus*, and in slightly broader premaxillæ also show gradation toward *desmarestianus*. The type series collected in August includes several young about two-thirds grown in which the soft coat characteristic of immaturity is beginning to give way to the hispid pelage of adults, the latter pelage appearing in patches on the face and rump.

Specimens examined.—Total number 13, from localities as follows:

Chiapas: Mountains near Tonala (type locality), 10.
Oaxaca: Guichicovi, 3.

HETEROMYS LONGICAUDATUS Gray.

Long-tailed Spiny Pocket Mouse.

(Pl. II, figs. 4, 4*a*.)

Heteromys longicaudatus Gray, Proc. Zool. Soc. Lond., pp. 204–205, 1868.

Type locality.—"Mexico."[1] Type, ♀ adult, in British Museum.

Distribution.—Low coastal plains of Tabasco, Mexico, and probably adjacent portions of Chiapas, southwestern Campeche, and northwestern Guatemala. Humid Tropical Zone.

General characters.—Size large; tail much longer than head and body, very thinly haired; color dark, but not so dark as in *H. desmarestianus*; ochraceous buffy lateral line present, but rather narrow and inconspicuous; sole of hind foot naked, six-tuberculate.

Color.—Fresh pelage: General color above between drab and mouse gray, darkest along median line of back, grizzled everywhere with slender ochraceous buffy hairs; pale ochraceous buffy lateral line very faint anteriorly, becoming more distinct across shoulders and along flanks, fading again on hind legs; underparts and feet white; outer sides of fore legs pale ochraceous buffy faintly tinged with dusky, continuous above with lateral line; ears and inner sides of ankles dusky, a dark line passing down along inner sides of legs leaving the heels white; tail dusky above, white below.

Cranial characters.—Skull large, with short heavy rostrum, broad nasals, premaxillæ, and frontals, and narrow zygomata and interparietal. More like that of *H. desmarestianus* than any other Mexican species, but rostrum broader and heavier, broadening more gradually to zygomata; nasals broader near middle; upper surface of maxillary root of zygoma more elongated; interparietal irregularly oval, with a projecting anterior angle; dentition as in *desmarestianus*.

Measurements.—Type:[2] Total length, 295; tail vertebræ, 170; hind foot, 37. An adult female from Montecristo, Tabasco: 312; 170; 36.

---

[1] Mr. Gerrit S. Miller, jr., who has compared for me specimens from numerous localities in Mexico with the type of *longicaudatus*, found that one from Montecristo, Tabasco, agrees almost exactly in size, color, and cranial characters.

[2] Measured by Gerrit S. Miller, jr.

Skull (♀ from Montecristo): Greatest length, 37.4; zygomatic breadth, 16.1; interorbital breadth, 9.5; length of nasals, 14.6; width of braincase, 15; alveolar length of upper molar series, 5.5.

Remarks.—Gray's original description of *longicaudatus* includes the following statement: "There is no indication of any yellow streak on the side, between the colors of the back and undersurface." In the single specimen in the Biological Survey collection (No. 100211), which Mr. Miller says "perfectly matches type of *longicaudatus* in color, size (295; 170; 37), and all visible external characters * * *," a pale lateral line is present, but is not so broad and conspicuous as in some species and may have been overlooked by Gray. This specimen represents a form apparently nearest to *desmarestianus*, but differing in paler color and the cranial characters already given. In breadth and general outline of rostrum and nasals it approaches *lepturus*, but the skull departs too widely in other respects to require close comparison.

Specimens examined:

Tabasco: Montecristo, 1.

HETEROMYS GOLDMANI Merriam.

GOLDMAN SPINY POCKET MOUSE.

(Pl. II, figs. 5, 5*a*.)

Heteromys goldmani Merriam, Proc. Biol. Soc. Wash., XV, pp. 41–42, Mar. 5, 1902.

Type locality.—Chicharras, Chiapas, Mexico. Type No. 77576, ♂ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, February 7, 1896.

Distribution.—Heavily forested Pacific slope of Sierra Madre in extreme southern Chiapas, Mexico, and probably adjacent portions of Guatemala. Humid Tropical Zone.

General characters.—Size very large; tail much longer than head and body, thinly haired; color very dark, the slender hairs inconspicuous; buffy lateral line absent; ears without white edging; pelage coarse; sole of hind foot naked, six-tuberculate.

Color.—*Fresh pelage:* General color above dark mouse gray, becoming slaty black over median dorsal area; feet and underparts (including lips and cheek pouches) white, the line of separation along sides very sharp; outer sides of forelegs mouse gray, passing above into general color of upperparts; ears and inner sides of ankles dusky· tail dusky above, whitish below (sometimes pure white at tip).

Cranial characters.—Skull large and angular, with rather flat rostrum, anteriorly spreading zygomata, and broad frontals shelving over orbits. In general form similar to that of *H. desmarestianus*, but larger; rostrum less decurved, flatter above; premaxillæ narrower and more tapering posteriorly, reaching, as in *desmarestianus*, slightly beyond nasals; frontals more prolonged anteriorly along intermaxillary suture; zygomata more spreading anteriorly; interparietal irregularly oval, broader transversely and relatively shorter antero-posteriorly than in *desmarestianus;* angle of mandible slightly everted; upper premolar with posterior lobe deeply infolded anteriorly; additional enamel island in posterior lobe of last upper molar persisting until removed by wear in extreme old age; tubercle over root of lower incisor moderately developed; last molar smaller than premolar. Compared with *temporalis*, the braincase is decidedly narrower and more arched; temporal ridges less widely separated; interparietal more oval, without the small posterior indentation present in *temporalis;* bullæ smaller.

Measurements.—Type: Total length, 347; tail vertebræ, 199; hind foot, 40. Average of four adult topotypes: 342 (335–350); 194 (186–201); 39.5 (38–41). *Skull* (average of five adults): Greatest length, 38.9 (38.2–40.2); zygomatic breadth, 18 (17.4–18.2); interorbital breadth, 9.9 (9–10.5); length of nasals, 16.4 (16–17.3); width of braincase, 15.9 (15.6–16.4); alveolar length of upper molar series, 5.6 (5.4–5.8).

Remarks.—This species, one of the largest of the genus, belongs to the *desmarestianus* group, but is apparently not closely allied to any of its near geographical neighbors. In general color, including the absence of a buffy lateral line, it resembles *temporalis*, but the cranial characters are distinctive.

Specimens examined.—Total number 9, from the following localities:

Chiapas: Chicharras (type locality), 7; Huehuetan, 2.

HETEROMYS LEPTURUS Merriam.

SANTO DOMINGO SPINY POCKET MOUSE.

Heteromys goldmani lepturus Merriam, Proc. Biol. Soc. Wash., XV, p. 42, Mar. 5, 1902.

Type locality.—Mountains near Santo Domingo (a few miles west of Guichicovi), Oaxaca, Mexico. Type No. 73382, ♂ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, June 20, 1895.

Distribution.—Humid, heavily forested mountain slopes and coastal plains in northeastern Oaxaca and southeastern Vera Cruz, Mexico. Humid Tropical Zone.

General characters.—Size large; tail long; general color dark, about as in *desmarestianus*, but ankles dusky all round (white on upper side in *desmarestianus*); ears without white edging, nearly naked; ochraceous buffy lateral line usually present, but narrow; sole of hind foot naked, six-tuberculate.

Color.—*Fresh pelage:* General color above between dark mouse gray and slaty black, darkest over median dorsal area; face and hind legs thickly grizzled with slender ochraceous buffy hairs; lateral line (when present) ochraceous buffy, narrow, extending from shoulder to hind leg; underparts and feet white; ankles all round and ears dusky; outer sides of forelegs and shoulders mouse gray tinged with buffy; tail dusky above, whitish below.

Cranial characters.—Skull large and massive, with heavy rostrum, anteriorly spreading zygomata; very broad frontals and basioccipital, and wide interparietal. General form similar to that of *longicaudatus*, but rostrum longer, more decurved anteriorly; braincase higher arched; premaxillæ broader, reaching farther posteriorly beyond nasals; zygomata more spreading anteriorly; frontals broader, the outer sides more strongly developed as supraorbital shelves; interparietal of similar shape, but wider transversely; temporal ridges curving less sharply inward posteriorly; basioccipital decidedly broader; dentition about as in *longicaudatus*.

Measurements.—Type: Total length, 340; tail vertebræ, 191; hind foot, 39. An adult topotype: 311; 176; 38. *Skull* (average of two adults): Greatest length, 37.4 (36.7–38.2); interorbital breadth, 10.5 (10.1–10.9); length of nasals, 15.4 (14.9–15.9); width of braincase, 15.4 (15.2–15.7); alveolar length of upper molar series, 5.3 (5.2–5.4).

Remarks.—*H. lepturus* is a well-marked species, although in external appearance closely resembling *desmarestianus*. It appears to be nearest in relationship to *longicaudatus*, but in combination of cranial characters differs decidedly from all the other members of the *desmarestianus* group. In some specimens from the lowlands of Vera Cruz and Oaxaca the lateral line is distinct as in the topotypes, while in others even from the same locality it is imperceptible.

Specimens examined.—Total number 8, from localities as follows:

Oaxaca: Mountains near Santo Domingo (type locality), 2; Choapam, 1; Tuxtepec, 1.
Vera Cruz: San Andres Tuxtla, 4.

HETEROMYS TEMPORALIS sp. nov.

MOTZORONGO SPINY POCKET MOUSE.

Type from Motzorongo, Vera Cruz, Mexico. No. 63719 (original No. 5915), ♀ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, Mar. 3, 1894.

Distribution.—Heavily forested eastern basal slopes of mountains in central Vera Cruz, Mexico. Humid Tropical Zone.

General characters.—Size large; tail longer than head and body; color dark, but not so dark as in *goldmani;* slender hairs ochraceous buffy, but inconspicuous; buffy lateral line absent; ears without white edging, nearly naked; inner side of ankle whitish; sole of hind foot naked, six-tuberculate.

Color.—*Fresh pelage:* General color of upperparts, including outer sides of forelegs to shoulders, mouse gray, varying to slaty black over lower part of face and median dorsal area, the slender ochraceous buffy hairs more abundant on head but only slightly affecting the general tone; underparts and feet white; ankles dusky, except a narrow line along inner side; tail dusky above, whitish below.

Cranial characters.—Skull very large, with slender rostrum and very broad, flat braincase. In general form similar to *goldmani*, but rostrum narrower, braincase broader and flatter; sagittal area much broader; temporal ridges following parietosquamosal suture (crossing parietals in *goldmani*), the area for muscular attachment below the ridges very narrow and not overlapping parietals; interparietal more triangular, the anterior angle more prominent; basioccipital narrower; auditory meatus larger; dentition as in *goldmani*.

Measurements.—Type: Total length, 320; tail vertebræ, 180; hind foot, 37. *Skull* (of same): Greatest length, 39.3; zygomatic breadth, 17.8; interorbital breadth, 10.2; length of nasals, 16.2; width of braincase, 16.8; alveolar length of upper molar series, 5.3.

Remarks.—This form appears to be more closely related to *goldmani* than to its nearer geographical neighbors. The skull, with temporal ridges bounding parietals laterally instead of crossing them, presents a condition not observed elsewhere in the genus.

Specimens examined:

Vera Cruz: Motzorongo (type locality), 3.

HETEROMYS REPENS Bangs.

CHIRIQUI SPINY POCKET MOUSE.

Heteromys repens Bangs, Bull. Mus. Comp. Zool., XXXIX, pp. 45–47, fig. 27, Apr., 1902.

Type locality.—Boquete, southern slope Volcan de Chiriqui, Panama (altitude 4,000 feet). Type No. 10356, ♀ adult, Museum of Comparative Zoology (collection of E. A. and O. Bangs), Cambridge, Mass., collected by W. W. Brown, jr., April 8, 1901.

Distribution.—Panama, and probably also in Costa Rica.

General characters.—Size large; tail slightly longer than head and body, bicolor; color very dark; slender hairs ochraceous buffy in adults; sole of hind foot naked, six-tuberculate. Somewhat like *H. desmarestianus*, but smaller; orange buffy lateral line absent; differing also in cranial characters. Similar in general external appearance to *anomalus* and *jesupi*, but even darker than either, and skull very different.

Color.—*Fresh pelage:* Upperparts dark mouse gray, shaded with blackish on median dorsal area and grizzled with pale ochraceous buffy hairs; underparts and feet white; lower part of face and outer sides of legs dark mouse gray; heels, sides of ankles, and base of tail blackish; ears dusky without distinct white edging; tail brownish above, dull whitish below, except at base, which is dark all round. *Young* (in first pelage): Face and sides of body very dark mouse gray, becoming blackish slate on median dorsal area, without trace of ochraceous buffy hairs.

Cranial characters.—Skull similar in general to that of *desmarestianus*, but smaller; rostrum broadening more gradually to zygomata; nasals reaching posteriorly beyond premaxillæ (nearly conterminous posteriorly in *desmarestianus*); molariform teeth smaller; supraorbital and temporal ridges well developed, as in *desmarestianus*. Compared with *jesupi* the skull is broader, with rostrum more tapering, less inflated anteriorly, broadening more gradually to zygomata; nasals broader anteriorly; braincase larger, more inflated; supraorbital and temporal ridges more developed; frontals much broader; interparietal narrower transversely; zygomata less squarely spreading anteriorly; molariform teeth smaller.

Measurements.—Type (from original description): Total length, 282; tail vertebræ, 150; hind foot, 33. Average of three adult topotypes: 289; 150; 33. *Skull* (average of two adults): Greatest length, 35.5 (35–36); interorbital breadth, 9.6 (9.4–9.9); length of nasals, 15; width of braincase, 15 (14.8–15.3); alveolar length of upper molar series, 5.1 (4.9–5.4).

Remarks.—*H. repens* is a well-marked form apparently more closely related to *desmarestianus* than to *jesupi* or any other known South American species. Four imperfect specimens, three from Angostura and one from Pacuare, Costa Rica, seem larger and somewhat different in cranial details from *repens*, but are not satisfactorily separable.

Specimens examined.—Total number 11, from the following localities:

Panama: Boquete, 6 (including type); Boqueron, 1.
Costa Rica: Angostura, 3; Pacuare, 1.

HETEROMYS FUSCATUS Allen.

NICARAGUA SPINY POCKET MOUSE.

(Pl. II, figs. 6, 6*a*.)

Heteromys fuscatus Allen, Bull. Amer. Mus. Nat. Hist., XXIV, pp. 652–653, Oct. 13, 1908.

Type locality.—Tuma, Nicaragua. Type No. 28451, ♂ adult, American Museum of Natural History, New York, collected by W. B. Richardson, December 1, 1907.

Distribution.—Central Nicaragua; limits of range unknown.

General characters.—Size and proportions about as in *H. repens;* color similar, but face more blackish; nasals and premaxillæ nearly conterminous posteriorly; sole of hind foot naked to heel, six-tuberculate. Smaller than *H. desmarestianus;* color about the same, but lateral line absent and ankles of type dusky all round as in *H. lepturus.*

Color.—Fresh pelage: General color of upperparts between dark mouse gray and slaty black, darkest over median dorsal area from nose to base of tail, rather heavily and uniformly grizzled with slender ochraceous buffy hairs; outer surface of forearms grayish tinged with buffy; outer surface of hind limbs and ankles all round dark mouse gray or blackish; underparts and feet white; nose and lower part of cheeks blackish; heels whitish; tail blackish above, whitish below, becoming dusky all round near tip.

Cranial characters.—Skull in size about equal to that of *repens*, but nasals and premaxillæ nearly conterminous (nasals reaching posteriorly beyond premaxillæ in *repens*). Rather closely resembling that of *desmarestianus*, but smaller; upper surface of maxillary root of zygoma relatively narrower and weaker; supraorbital ridges well developed and shelf-like, as in *desmarestianus*.

Measurements.—Type (from original description): Total length, 300; tail, 150; hind foot, 30. *Skull* (type): Greatest length, 36.7; zygomatic breadth, 17.3; interorbital breadth, 10; length of nasals, 15.3; width of braincase, 15.6; alveolar length of upper molar series, 5.5.

Remarks.—H. fuscatus is somewhat intermediate in general characters between *repens* and *desmarestianus*. It agrees more closely in size with *repens*, but in general color and many cranial details is much like *desmarestianus*. Specimens from Matagalpa and Chontales are about like the type in color, but instead of wholly dark ankles have a white line along inner surface of leg to foot as in *desmarestianus*.

Specimens examined.—Total number 4, from localities as follows:

Nicaragua: Tuma, 1 (type); Matagalpa, 2; Chontales, 1.

HETEROMYS GAUMERI Allen and Chapman.

Gaumer Spiny Pocket Mouse.

(Pl. II, figs. 7, 7*a*.)

Heteromys gaumeri Allen and Chapman, Bull. Amer. Mus. Nat. Hist., IX, pp. 9–11, Feb., 1897.

Type locality.—Chichen Itza, Yucatan, Mexico. Type No. $\frac{12028}{10461}$, ♂ adult, American Museum of Natural History, New York, collected by Frank M. Chapman, March 17, 1896.

Distribution.—Yucatan and northern parts of Campeche and Quintana Roo, Mexico. Arid and Humid Tropical Zones.

General characters.—Size large; tail longer than head and body; orange buff lateral line very broad and conspicuous; sole of hind foot thinly haired posteriorly, six-tuberculate, the posterior tubercle very small. Not closely related to any known species.

Color.—Partly worn pelage: General color above dark mouse gray heavily grizzled with orange buff, becoming rich orange buff along broad lateral line from sides of face to base of tail; underparts and feet pure white; outer sides of forearms orange buffy, interrupted above by a white line; nose dusky; ears dusky, faintly edged with whitish; tail brownish above, dull white below, with a small blackish terminal tuft of longer hairs.

Cranial characters.—Skull rather long and angular, with supraorbital ridges strongly developed laterally as overhanging shelves. In size similar to *H. longicaudatus*, but rostrum narrower; nasals much less broadly expanded anteriorly; zygomata more spreading; interparietal similar in shape, but broader transversely; molariform teeth smaller; audital bullæ larger.

Measurements.—Type (from original description): Total length, 292; tail vertebræ, 162; hind foot, 32. An adult male from type locality: 277; 155; 35. Average of three adults from Tunkas (near type locality): 297 (295–300); 163 (160–166); 34.5 (34–35). *Skull* (average of same): Greatest length, 36.4 (35.9–36.9); zygomatic breadth, 16.5 (16.4–16.5); interorbital breadth, 8.5 (8.2–8.7); length of nasals, 14.8 (14.1–15.2); width of braincase, 14.9 (14.7–15.2); alveolar length of upper molar series, 4.9.

Remarks.—This well-marked species differs from the other Mexican members of the genus in having the soles of hind feet hairy posteriorly. It is also remarkable for the unusual width and rich coloration of the lateral lines from cheeks to tail. The posterior tubercle on the sole of the hind foot is very small for so large a species.

For convenience *H. gaumeri* is here included in the *desmarestianus* group, but is a somewhat aberrant species, presenting characters which set it off from all the others. Specimens from the humid, heavily forested interior of east-central Campeche and the northeast coast of Quintana Roo are not appreciably different from those of the animal inhabiting the arid districts of Yucatan.

Specimens examined.—Total number 30, from localities as follows:

Yucatan: Chichen Itza (type locality), 7; Progreso, 1; Tunkas, 6.
Campeche: Apazote, 6; Campeche, 1.
Quintana Roo: La Vega, 5; Puerto Morelos, 4.

Subgenus XYLOMYS Merriam.

Type.—Heteromys (Xylomys) nelsoni Merriam, from Pinabete, Chiapas, Mexico.

Distribution.—Known only from Pinabete, Chiapas, Mexico.

Subgeneric characters.—Pelage composed of soft bristles intermixed with slender hairs; sole of hind foot naked, six-tuberculate; inner sides of forearms dusky. Braincase high and rounded; temporal ridges faint; upper surface of maxillary root of zygoma large and irregularly rectangular; parietals prolonged laterally along lambdoid crest, reaching or nearly reaching mastoids, thus more or less completely separating squamosal from supraoccipital; angle of mandible very slightly everted. Molariform tooth rows very broad posteriorly, the last molars equal to or broader than premolars; posterior prism of last upper molar and anterior prism of lower premolar with two transverse loops, confluent near middle, and usually uniting through wear at inner or outer ends; last lower molar with a distinct pit at postero-external base; lower incisor without trace of tubercle over root.

Remarks.—The subgenus *Xylomys* is represented by a single known species, possibly a survivor of an earlier group with more complicated dentition. *Xylomys* departs from the subgenus *Heteromys* mainly in the greater posterior width of molariform tooth rows, the weakly developed root of lower incisor, the more numerous and intricate enamel folds in crowns of posterior upper molars, and the lateral extension of parietals along lambdoid crest to mastoids. It differs also in the softness of its pelage, which in the adult state resembles the condition usual in the genus during adolescence.

HETEROMYS NELSONI Merriam.

NELSON SPINY POCKET MOUSE.

(Pl. I, figs. 2, 2*a*, 2*b*, 2*c*, 2*d*.)

Heteromys (*Xylomys*) *nelsoni* Merriam, Proc. Biol. Soc. Wash., XV, pp. 43–44, Mar. 5, 1902.

Type locality.—Pinabete, Chiapas, Mexico (altitude 8,200 feet). Type No. 77920, ♂ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, February 11, 1896.

Distribution.—Humid, heavily forested Pacific slopes of Sierra Madre in southern Chiapas, Mexico, and doubtless adjacent portions of Guatemala

General characters.—Size very large, exceeding that of *H. goldmani;* tail much longer than head and body, thinly haired; and as in subgenus *Heteromys*, ears rather large, nearly naked, dusky and without distinct white edging; pelage soft; general color mouse gray; lateral line absent; sole of hind foot naked, six-tuberculate.

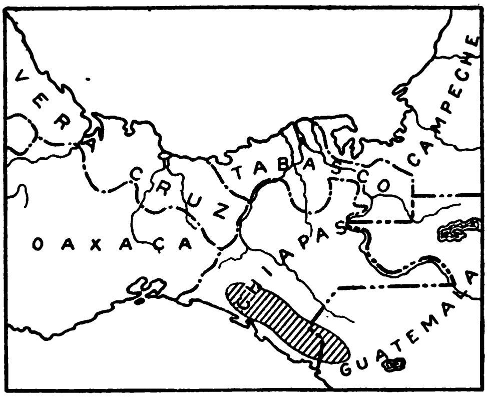


FIG. 3.—Distribution of *Heteromys* (*Xylomys*) *nelsoni.*

Color.—*Fresh pelage:* General color above mouse gray, becoming blackish along median line from nose to base of tail; forefeet and underparts, including lips and cheek pouches, white; outer sides of fore limbs to feet mouse gray, this color extending all round forearms except a narrow line along underside; hind feet white, faintly clouded along upper side to toes; ears, heels, and inner sides of ankles dusky; tail dusky above, whitish below except tip, which is dark all round.

Cranial characters.—Skull long and narrow; rostrum long, not tapering anteriorly, slightly constricted in front of zygomata; braincase high and rather smoothly rounded; supraorbital and temporal ridges faint; zygomata widest anteriorly, the upper surface of maxillary root large and somewhat rectangular; nasals very broad anteriorly, narrowing gradually posteriorly, the ends slightly emarginate; premaxillæ narrowing gradually, conterminous posteriorly with nasals; frontals elongated along median line, crowding nasals and premaxillæ far forward, but not prolonged along intermaxillary suture; interparietal small and oval; palate narrow between tooth rows; palatopterygoids slender; basioccipital narrow; audital bullæ, including meatus, large and inflated; dentition heavy.

Measurements.—Type: Total length, 356; tail vertebræ, 195; hind foot, 43.5. *Skull* (of same): Greatest length, 41.1; zygomatic breadth, 18; interorbital breadth, 9.3; length of nasals, 16.3; width of braincase, 15.8; alveolar length of upper molar series, 6.2.

Remarks.—*H. nelsoni* is the largest species of the genus known to occur in Mexico. It differs too widely from all the others to require close comparison with any of them. Externally it may be readily known by the remarkable softness of the pelage.

Specimens examined:

Chiapas: Pinabete (type locality), 2.

Genus LIOMYS Merriam.

Type.—*Heteromys alleni* Coues, from Rio Verde, San Luis Potosi, Mexico.

Liomys Merriam, Proc. Biol. Soc. Wash., XV, p. 44, Mar. 5, 1902.

Liomys Elliot, Mamm. Middle Amer. and W. Indies. Field Columb. Mus. Pub., Zool. Ser., IV, Pt. I, p. 374, 1904 (subgenus).

Distribution.—Tropical and Sonoran Zones from southern Texas and Sonora to Panama.

Generic characters.—Similar in general to *Heteromys;* pelage hispid; tail usually well haired; sole of hind foot hairy posteriorly (except possibly in *adspersus*), five- or six-tuberculate; inner sides of forearms pure white. Skull usually broad, with narrow rostrum; interpterygoid fossa U-shaped, broad and rounded anteriorly; angle of mandible strongly everted. Last molars decidedly narrower than premolars; tubercle over root of lower incisior large; posterior loop in crown of upper premolar with anterior border concave or slightly notched, but without deep reentrant angle; loops of molar crowns normally without additional enamel islands even in young.

Remarks.—The genus *Liomys* includes a number of slightly differentiated forms, some of which inhabit the Sonoran zones on the tablelands of Mexico. It is characterized by simpler, heavier dentition than *Heteromys;* the additional enamel islands or small reentrant angles in the loops of molariform teeth, present at least in the young of *Heteromys* and *Xylomys*, are normally absent in *Liomys*. The genus is readily divisible into three well-marked but rather closely allied groups: the *irroratus* group with soles of hind feet five-tuberculate, confined mainly to the Sonoran zones; the *pictus* group, nearly related to the preceding, with remarkably rich coloration, soles of hind feet usually six-tuberculate but varying to five, restricted mainly to Tropical zones; and the slightly more divergent *crispus* group with plain coloration and ranging wholly within the Tropical zones. In dental characters the *crispus* group differs notably from both the others in that the obliteration of the transverse sulcus in the first upper molar is not accompanied by the formation of a central enamel island, to be removed in turn by prolonged wear of the molar crown. This difference is apparent only in young adult individuals in which the obliteration of the transverse sulcus is still in progress. The three groups seem to represent distinct assemblages of species and subspecies, as partly shown by the overlapping of the groups in geographic range.

LIOMYS PICTUS GROUP.

LIOMYS PICTUS (Thomas).

PAINTED SPINY POCKET MOUSE.

(Pl. III, figs. 1, 1*a*.)

Heteromys pictus Thomas, Ann. Mag. Nat. Hist., ser. 6, XII, pp. 233–234, Sept., 1893.
Heteromys hispidus Allen, Bull. Amer. Mus. Nat. Hist., IX, pp. 56–57, Mar. 15, 1897.
Type from Compostela, Tepic, Mexico, No. $\frac{8884}{6667}$. ♀ ad., Amer. Mus. Nat. Hist., collected by Dr. Audley C. Buller, Feb. 11, 1893.

Type locality.—Mineral San Sebastian, Jalisco, Mexico (altitude, 4,300 feet). Type, ♀, in British Museum, collected by Dr. Audley C. Buller, May 9, 1893.

Distribution.—Coastal plains and basal mountain slopes in western Jalisco and Colima and probably western Michoacan. Arid Tropical Zone.

General characters.—Size rather small; tail longer than head and body, sharply bicolor; color reddish; orange buffy lateral line broad and distinct; ears edged with whitish; sole of hind foot hairy posteriorly, six-tuberculate.

Color.—*Fresh pelage:* General color above grizzled reddish brown, the result of intermixed brownish or dark grayish bristles and orange buff hairs, the latter unusually abundant and conspicuous; lateral line rich orange buff, broad and distinct from cheeks to hind legs; underparts and feet white; outer sides of forelegs varying from grayish to orange buffy, the color continuous along a narrow line with general color of upperparts, or interrupted by a white area below lateral line; outer side of hind legs mouse gray; sides of ankles, and sometimes heels, dusky; ears dusky, narrowly edged with whitish; tail brownish above, white below.

Cranial characters.—Skull long and narrow, with weakly developed supraorbital ridges, large subtriangular interparietal, and posteriorly truncate nasals; premaxillæ reaching posteriorly well beyond nasals; angle of mandible short, heavy, and everted; coronoid process small. Compared with that of *plantinarensis* the skull is much larger, longer, relatively narrower, and less arched; braincase less inflated; premaxillæ longer, passing farther posteriorly beyond nasals; interparietal larger; nasals normally truncate instead of deeply emarginate posteriorly.

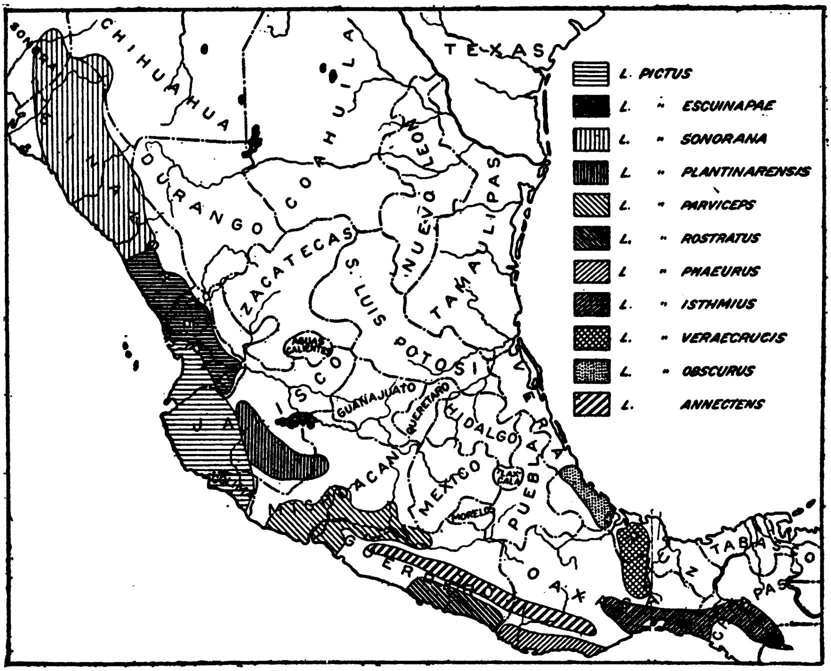


FIG. 4.—Distribution of *Liomys pictus* and allied forms.

Measurements.—Type (from original description): Head and body, 104; tail, 113; hind foot (without claw?), 24.8. Average of five adult topotypes: Total length, 251 (232–260); tail vertebræ, 136 (117–146); hind foot, 29.4 (27.5–31). *Skull* (average of same): Greatest length, 31.9 (30.9–33); zygomatic breadth, 14.3 (14.1–15); interorbital breadth, 7.5 (7.2–7.8); length of nasals, 13.3 (13.2–13.6); width of braincase, 13.8 (13.2–14); alveolar length of upper molar series, 4.9 (4.6–5).

Remarks.—*L. pictus* typifies a group of closely related forms characterized by rather small size, usually broad lateral line, and rich orange buffy coloration of slender dorsal hairs. The hind foot is usually six-tuberculate, but in some forms the number of tubercles may be either five or six. In Mexico the group is restricted in distribution to the tropical or subtropical coastal slopes from southern Sonora and central Vera Cruz to Guatemala.

Aside from its subspecies, *pictus* requires no close comparison with any known form. Near the coast of southern Tepic it intergrades with *escuinapæ*, and in the interior of western and southern Jalisco with *plantinarensis*. Specimens from the State of Colima vary considerably in size and have nasals more or less emarginate posteriorly, but agree otherwise with *pictus*.

H. hispidus of Allen seems inseparable from *pictus*. The type and a topotype agree in cranial characters with typical specimens of the latter form. The skins appear to have been immersed in alcohol, with the result that the blackish element in the pelage is somewhat faded and the reddish intensified.

Specimens examined.—Total number 90, from the following localities:

Jalisco: San Sebastian (type locality), 26; Arroyo de Plantinar, 6; Ixtapa, 5; Rio Santa Maria, 8; Sal si Puedes, 1; Wakenakili Mountains, 6.

Colima: Armeria, 11; Colima, 10; Hacienda Magdalena, 7; Hacienda San Antonio, 2.

Tepic: Compostela, 2; Navarete, 2; Santiago, 4.

LIOMYS PICTUS ESCUINAPÆ (Allen).

Escuinapa Spiny Pocket Mouse.

Heteromys pictus escuinapæ Allen, Bull. Amer. Mus. Nat. Hist., XXII, pp. 211–212, July 25, 1906.

Type locality.—Escuinapa, Sinaloa, Mexico. Type No. 24502, ♂ young adult, American Museum of Natural History, collected by J. H. Batty, February 3, 1904.

Distribution.—Coastal plains and Pacific slopes of Sierra Madre from southern Sinaloa southward, passing into typical *pictus* in southern Tepic and northwestern Jalisco. Arid Tropical and Lower Sonoran Zones.

General characters.—Closely related to *pictus*, but slightly grayer; nasals emarginate, instead of truncate, posteriorly; hind foot six-tuberculate as in *pictus*. Differing from *sonorana* in slightly darker, richer color and less deeply emarginate nasals.

Color.—About as in *pictus*, but slightly grayer, orange buffy hairs less numerous and conspicuous.

Cranial characters.—Skull similar to that of *pictus*, but shorter and relatively broader; nasals shorter and broader, emarginate instead of truncate posteriorly; premaxillæ less prolonged posteriorly beyond nasals; interparietal smaller. In general form similar to that of *sonorana*, but smaller; nasals less deeply emarginate posteriorly.

Measurements.—Type (from original description): Total length, 216; tail vertebræ, 108; hind foot (without claws), 24. Average of nine adult males: Total length, 223; tail vertebræ, 114.8; hind foot (without claws), 24.6. Average of eight adult females: Total length, 211.3; tail vertebræ, 109; hind foot (without claws), 23.4. *Skull* (average of six adults): Greatest length, 31 (29.9–31.9); zygomatic breadth, 14.6 (14.2–15.3); interorbital breadth, 7.7 (7.2–8); length of nasals, 12.8 (11.9–13.7); width of braincase, 13.8 (13.4–14.6); alveolar length of upper molar series, 4.9 (4.8–5).

Remarks.—This subspecies is intermediate in general characters and geographic position between *pictus* and *sonorana*, and specimens examined from numerous localities show complete intergradation with both. Specimens from the city of Tepic appear to be much closer to *escuinapæ* than to *pictus*, although the latter is nearly typical at Compostela, only a few miles away. Of a series of 10 skulls from Estancia, in northwestern Jalisco, two have the squarely truncate nasals of *pictus*, but are somewhat broader and in other respects agree with *escuinapæ*. Specimens from Culiacan, Sinaloa, and from Chacala, Durango, seem referable to *sonorana*, but in richer color and rather less deeply emarginate nasals indicate an approach to *escuinapæ*.

Specimens examined.—Total number 125, from the following localities:

Sinaloa: Escuinapa, 26 (including type); Mazatlan, 15; Plomosas, 11; Rosario, 6.

Jalisco: Estancia, 10.

Tepic: Acaponeta, 21; Amatlan, 9; Ojo de Agua (near Amatlan), 4; Pedro Pablo, 1; Rancho Palo Amarillo (near Amatlan), 13; Tepic, 9.

LIOMYS PICTUS SONORANA Merriam.

SONORA SPINY POCKET MOUSE.

Liomys sonorana Merriam, Proc. Biol. Soc. Wash., XV, p. 47, Mar. 5, 1902.

Type locality.—Alamos, Sonora, Mexico. Type No. 96252, ♂ adult, United States National Museum (Biological Survey collection), collected by E. A. Goldman, December 19, 1898.

Distribution.—Arid coastal plains and basal slopes of Sierra Madre from southern Sonora to southern Sinaloa. Mainly overlapping portions of Lower Sonoran and Arid Tropical Zones.

General characters.—Similar in size to *pictus* and *escuinapæ*, but color grayer, less tawny; lateral line narrower and paler; tail more hairy; skull with broad braincase and slender rostrum; hind foot six-tuberculate.

Color.—*Fresh pelage:* General color of upperparts pale mouse gray, coarsely grizzled with orange buffy hairs; underparts and feet white;

lateral line from cheeks to hind legs ochraceous buff; outer sides of forearms varying from pure white to very pale grayish buffy; ears edged with whitish; tail dusky above, whitish below on basal portion, darkening gradually toward tip, which is dusky all round.

Cranial characters.—Skull rather large and heavy, with broad braincase, narrow rostrum, small interparietal, and deeply emarginate nasals. Compared with *pictus*, the skull is broader and heavier; braincase larger; rostrum narrower, the sides more nearly parallel, broadening more abruptly at zygomata; maxillary root of zygoma heavier; nasals deeply emarginate instead of truncate posteriorly; interparietal smaller; dentition heavier. Differs from *escuinapæ* mainly in larger average size, heavier maxillary roots of zygomata, and more deeply emarginate nasals.

Measurements.—Type: Total length, 262; tail vertebræ, 142; hind foot, 32.5. Average of four adult topotypes: 243 (222–262); 129 (119–142); 30.9 (30–32.5). *Skull* (average of same): Greatest length, 33 (32.3–34.4); zygomatic breadth, 15.3 (15–15.5); interorbital breadth, 7.6 (7.2–7.9); length of nasals, 14.4 (13.3–15); width of braincase, 14.4 (14.3–14.4); alveolar length of upper molar series, 5.2 (5–5.5).

Remarks.—The range of *sonorana* marks the extreme northern limit of the genus. The most northern locality from which specimens are known is Camoa, on the Rio Mayo in Sonora, but the subspecies probably reaches at least a few miles farther north along the basal slopes of the Sierra Madre. From the northern part of its range *sonorana* changes progressively toward the south, assuming richer colors and presenting less extreme cranial characters, passing into *escuinapæ* in the region south of Mazatlan.

Specimens examined.—Total number 49, from the following localities:

Sonora: Alamos (type locality), 12; near Alamos, 2; Camoa, 4.
Chihuahua: Near Batopilas, 2.
Durango: Chacala, 10.
Sinaloa: Culiacan, 10; Sierra de Choix (50 miles northeast of Choix), 7; Sinaloa, 2.

LIOMYS PICTUS PLANTINARENSIS Merriam.

PLANTINAR SPINY POCKET MOUSE.

Liomys plantinarensis Merriam, Proc. Biol. Soc. Wash., XV, p. 46, Mar. 5, 1902.

Type locality.—Plantinar, Jalisco, Mexico. Type No. $\frac{33595}{45630}$, ♀ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, April 4, 1892.

Distribution.—Interior valleys and deep canyons along the western slopes of the plateau region in western and southern Jalisco and northwestern Michoacan. Mainly Arid Tropical Zone.

General characters.—Size very small; color reddish; orange buffy lateral lines usually broad and distinct; ears edged with whitish. Closely resembling *L. pictus* in color, but decidedly smaller, hind foot five- or six-tuberculate.

Color.—Fresh pelage: Upperparts grizzled reddish brown, resulting from intermixed dusky or grayish tipped bristles and orange buffy hairs, the general color darkest over median dorsal area; lateral line orange buff, extending from cheeks to hind legs; underparts and feet white; outer sides of forelegs pale grayish or orange buffy, the color in some specimens continuous above with lateral line, in others interrupted by a white area; outer sides of hind legs mouse gray; ears dusky, narrowly edged with whitish; tail brownish above, white below.

Cranial characters.—Skull similar in general to that of *pictus*, but smaller, shorter, relatively broader and higher arched; braincase more inflated; premaxillæ usually shorter, reaching only slightly beyond nasals posteriorly; interparietal shorter antero-posteriorly, with less developed anterior angle; nasals deeply emarginate instead of truncate posteriorly; dentition of the *pictus* type, but relatively heavier. Compared with that of *parviceps* the skull is larger, with braincase more arched and inflated; interparietal decidedly larger; rostrum more decurved.

Measurements.—Type: Total length, 202; tail vertebræ, 102; hind foot, 26. Average of five adults from Los Reyes, Michoacan: 219; 113; 26.5. *Skull* (type): Greatest length, 29.3; zygomatic breadth, 14; interorbital breadth, 7.4; length of nasals, 12.7; width of braincase, 13.4; alveolar length of upper molar series, 4.9.

Remarks.—This subspecies unites close external resemblance to *pictus* with smaller size and a different combination of cranial characters. Specimens from Ameca, Jalisco, have larger skulls than the type, with less deeply emarginate nasals and seem to be grading toward *pictus*. Those from Los Reyes, Michoacan, are darker in color, but in flatter braincase and small interparietal seem to show an approach to *parviceps*. The number of tubercles on the sole of the hind foot is very constant in most members of the genus, but varies from five to six in *plantinarensis* (five in the type).

Specimens examined.—Total number 19, from the following localities:

Jalisco: Plantinar, 1 (type); Ameca, 5.
Michoacan: Los Reyes, 13.

LIOMYS PICTUS PARVICEPS Goldman.

LA SALADA SPINY POCKET MOUSE.

(Pl. III, figs. 2, 2*a*.)

Liomys parviceps Goldman, Proc. Biol. Soc. Wash., XVII, p. 82, Mar. 21, 1904.

Type locality.—La Salada, 40 miles south of Uruapan, Michoacan, Mexico. Type No. 126477, ♀ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, March 19, 1903.

Distribution.—Arid valley of the Balsas River in southern Michoacan and northern and extreme western Guerrero, Mexico. Arid Tropical Zone.

General characters.—Most like *plantinarensis* but less reddish; lateral line narrower or absent; outer sides of forearms usually pure white (grayish or buffy in *plantinarensis*); skull smaller; hind foot shorter, usually six-tuberculate.

Color.—*Fresh pelage:* Upperparts mouse gray, darkest on median dorsal area, thinly grizzled with orange buffy hairs; underparts and feet white; outer sides of forearms usually pure white, rarely tinged with pale grayish buff; lateral line, when present, orange buff, narrow and rather indistinct; ears edged with whitish; tail brownish above, white below.

Cranial characters.—Skull smallest of the known species of the genus. Resembling that of *plantinarensis,* but smaller and flatter; braincase less expanded; interparietal decidedly smaller; rostrum less decurved; nasals emarginate posteriorly, as in *plantinarensis.*

Measurements.—Type: Total length, 202; tail vertebræ, 110; hind foot, 24. Average of five adult topotypes: 204; 105; 24. *Skull* (average of five adults): Greatest length, 28 (26–28.3); zygomatic breadth, 13.1 (12.7–13.3); interorbital breadth, 6.6 (6.4–6.8); length of nasals, 11.2 (10.1–11.7); width of braincase, 12.6 (12.4–12.9); alveolar length of upper molar series, 4.4 (4.2–4.5).

Remarks.—The present form requires comparison only with *plantinarensis.* It is approached in cranial characters by specimens of the latter species from Los Reyes, Michoacan, and through *plantinarensis* probably intergrades with *pictus. Parviceps* appears to be restricted in distribution to the extremely arid region along the Balsas River and its tributaries. Six tubercles are usually present on the sole of the hind foot, but the smallest is clearly absent in a few specimens examined, and scarcely large enough to be perceptible in some others.

Specimens examined.—Total number 29, from the following localities:

Michoacan: La Salada (type locality), 12; La Huacana, 3.
Guerrero: El Limon, 9; Rio Balsas, 5.

LIOMYS PICTUS ROSTRATUS Merriam.

OMETEPEC SPINY POCKET MOUSE.

Liomys pictus rostratus Merriam, Proc. Biol. Soc. Wash., XV, p. 46, Mar. 5, 1902.

Type locality.—Near Ometepec, Guerrero, Mexico. Type No. 71488, ♂ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, February 14, 1895.

Distribution.—Arid coastal plains and basal mountain slopes in southeastern Guerrero, Mexico. Arid Tropical Zone.

General characters.—Similar in size to *pictus;* color similar; skull heavier, broader across maxillary roots of zygomata; interparietal more oval; hind foot six-tuberculate, as in *pictus*. Closely related to *phæurus*, but tail whitish below (dusky toward tip in *phæurus*); skull more massive; interparietal more oval.

Color.—As in *pictus*.

Cranial characters.—Skull similar in general to that of *pictus*, but more massive, broader across anterior roots of zygomata; maxillary branches of zygomata heavier and more widely spreading; nasals broader, truncate or emarginate posteriorly; interparietal more oval, with scarcely a trace of the anterior angle. From *phæurus* the skull differs in the same characters as from *pictus*.

Measurements.—Type: Total length, 252; tail vertebræ, 133; hind foot, 29. Average of five adult topotypes: 249 (235–262); 132 (120–145); 29.1 (28–30). *Skull* (average of five adults): Greatest length, 32.7 (31.7–33.5); zygomatic breadth, 15 (14.6–15.5); interorbital breadth, 7.8 (7–8.1); length of nasals, 13.7 (13.1–14.5); width of braincase, 14 (13.5–14.4); alveolar length of upper molar series, 4.8 (4.5–4.9).

Remarks.—In color *rostratus* agrees with *pictus*. The cranial characters, although rather well marked, indicate close relationship to both *pictus* and its nearer geographic neighbor *phæurus*. Specimens from Acapulco and Acahuizotla exhibit much individual variation and point to complete intergradation with *pictus* farther northward along the coast of Guerrero or Michoacan.

Specimens examined.—Total number 28, from localities as follows:

Guerrero: Near Ometepec (type locality), 10; Acapulco, 14; Acahuizotla, 4.

LIOMYS PICTUS PHÆURUS Merriam.

DUSKY-TAILED SPINY POCKET MOUSE.

Liomys phæura Merriam, Proc. Biol. Soc. Wash., XV, p. 48, Mar. 5, 1902.

Type locality.—Pinotepa, Oaxaca, Mexico. Type No. 71500, ♀ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, February 21, 1895.

Distribution.—Arid coastal region of southwestern Oaxaca. Arid Tropical Zone.

General characters.—Slightly smaller than *pictus;* color less reddish; orange buff lateral line narrower; tail dark all round on terminal half (whitish below in *pictus*); hind foot six-tuberculate. Closely related to *rostratus*, but smaller; tail dusky instead of white below on terminal half; interparietal triangular (oval in *rostratus*). Differing from *isthmius* mainly in darker tail, more conspicuous lateral line, and shorter, relatively broader, skull.

Color.—*Worn pelage:* General color of upperparts mouse gray, darkest on median dorsal area, thinly grizzled with orange buffy hairs; underparts and feet white; lateral line from cheeks to hind legs orange buff; outer sides of forearms edged with grayish; upper side of tail brownish, under side whitish at base and darkening gradually on terminal half.

Cranial characters.—Skull most like that of *pictus*, but shorter and relatively broader; frontals broader; interparietal smaller. Similar to that of *rostratus*, but smaller, shorter, and less massive; nasals much narrower; zygomata more squarely spreading, the maxillary roots weaker, with frontopremaxillary border less convex; braincase shorter. less projecting posteriorly over foramen magnum; interparietal more triangular, the anterior angle well developed and posterior border less convex; nasals usually emarginate, but sometimes truncate posteriorly. From *isthmius* the skull differs in about the same respects as from *pictus.*

Measurements.—Type: Total length (tail imperfect), 204; tail vertebræ (tip gone), 95; hind foot, 29. Average of three adults from Llano Grande, Oaxaca (near type locality): 230 (215–239); 115 (106–120); 29 (28.5–29.5). *Skull* (average of three adults): Greatest length, 31.5 (30.5–32.6); zygomatic breadth, 14.7 (14.6–15); length of nasals, 12.9 (12–14); width of braincase, 13.2 (12.1–14.5); alveolar length of upper molar series, 4.7 (4.4–5).

Remarks.—This form appears to be as closely related to typical *pictus* as to its nearer geographic neighbor *rostratus.* Specimens from Puerto Angel have less dusky tails than those from near the type locality and in cranial characters grade toward *isthmius.*

Specimens examined.—Total number 18, from localities as follows:

Oaxaca: Pinotepa (type locality), 2; Llano Grande, 7; Puerto Angel, 9.

LIOMYS PICTUS ISTHMIUS Merriam.

Isthmian Spiny Pocket Mouse.

Liomys pictus isthmius Merriam, Proc. Biol. Soc. Wash., XV, p. 46, Mar. 5, 1902.

Type locality.—Tehuantepec, Oaxaca, Mexico. Type No. 73367, ♂ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, April 28, 1895.

Distribution.—Arid coastal plains and interior valleys on the southern side of the Isthmus of Tehuantepec in southeastern Oaxaca and western Chiapas and thence eastward through the valley of the Chiapas River to Nenton, Guatemala. Arid Tropical Zone.

General characters.—Similar to *pictus*, but color paler, less reddish, the lateral line narrower or absent, and outer sides of fore limbs pure white instead of grayish or buffy; hind foot six-tuberculate, as in *pictus.* Closely related to *phæurus*, but tail whitish instead of dusky on terminal lower part, and skull larger and heavier. Differing from *veræcrucis* in paler color and less massive skull.

Color.—*Fresh pelage:* Upperparts mouse gray, grizzled with orange buffy; underparts, fore limbs, and hind feet white; lateral line, when present, orange buffy; tail brownish above, white below.

Cranial characters.—Skull closely resembling that of *pictus*, but rostrum more slender; premaxillæ less prolonged posteriorly beyond nasals; nasals emarginate instead of truncate posteriorly; interparietal slightly smaller. Similar to *veræcrucis*, but narrower and less massive; rostrum more slender; sagittal area narrower; lateral borders of frontals less deeply concave; zygomata less widely spreading. The skull differs from *phæurus* mainly in broader nasals and more oval interparietal.

Measurements.—Type: Total length, 245; tail vertebræ, 130; hind foot, 30. Average of five adult topotypes: 243 (226–257); 131 (121–140); 29.9 (29–30.5). *Skull* (average of five adults): Greatest length, 31.4 (30.4–32.2); zygomatic breadth, 14.5 (13.9–15.4); interorbital breadth, 7.7 (7.4–7.9); length of nasals, 13 (12.9–13.4); width of brain case, 13.7 (13.2–14.4); alveolar length of upper molar series, 4.6 (4.3–4.8).

Remarks.—In cranial characters *isthmius* is nearer *pictus* than to the geographically intervening forms through which they grade together. Specimens from Puerto Angel show intergradation with *phæurus*. Those from Santo Domingo and San Juan Guichicovi are intermediate, but nearer *veræcrucis*, which occupies the more humid area north of the range of *isthmius*. Many specimens from Tonala, Santa Efigenia, and the Chiapas Valley are darker and richer colored than topotypes, and those from the latter region usually have broader nasals, but these differences appear too slight to merit subspecific recognition.

Specimens examined.—Total number 85, from the following localities:

Oaxaca: Tehuantepec (type locality), 16; near Tehuantepec, 14; Chicapa, 1; Huilotepec, 3; San Bartolo, 3; Santa Efigenia, 14.
Chiapas: San Bartolome, 6; San Vicente, 1; Tonala, 6; Tuxtla Gutierrez, 14; Valley of Jiquipilas, 3.
Guatemala: Nenton, 4.

LIOMYS PICTUS VERÆCRUCIS Merriam.

VERA CRUZ SPINY POCKET MOUSE.

Liomys veræcrucis Merriam, Proc. Biol. Soc. Wash., XV, p. 47, Mar. 5, 1902.
Liomys orbitalis Merriam, Proc. Biol. Soc. Wash., XV, pp. 48–49, Mar. 5, 1902. Type from Catemaco, Vera Cruz, Mexico. No. 65452, ♀ ad., U. S. Nat. Mus. (Biological Survey collection), collected by Nelson and Goldman, Apr. 29, 1894.

Type locality.—San Andres Tuxtla, Vera Cruz, Mexico. Type No. 65457, ♀ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, May 7, 1894.

Distribution.—Humid northern slopes of the Isthmus of Tehuantepec, and coastal plains in southern Vera Cruz, Mexico. Humid Tropical Zone.

General characters.—Smaller than *pictus;* tail shorter; color darker, less tawny; lateral line much narrower; skull more massive; hind foot six-tuberculate, as in *pictus.* Intergrading with *obscurus* and *isthmius,* but differing from both in darker color and heavier skull.

Color.—*Fresh pelage:* General color of upperparts grizzled, dark reddish brown, the result of intermixed dark grayish or brownish bristles and orange buffy hairs (in worn pelage varying to blackish slate on median dorsal area); underparts and feet white; lateral line from cheeks to hind legs orange buffy, narrow, and in some specimens indistinct; outer sides of forelegs more or less distinctly grayish or buffy; hind legs mouse gray; ears edged with whitish; tail brownish above, white below.

Cranial characters.—Skull short and massive, with heavy rostrum and widely spreading zygomata. Compared with *pictus, isthmius,* and *obscurus,* the skull in general is relatively shorter, broader, and heavier; braincase more inflated; nasals usually shorter and broader, truncate or emarginate posteriorly; ascending branches of premaxillæ heavier, reaching posteriorly slightly beyond nasals; lateral borders of frontals more deeply concave; sagittal area broader; maxillary root of zygoma usually shorter and heavier than in *pictus* and *isthmius*—much heavier than in *obscurus;* interparietal about as in *isthmius,* but rather broad transversely.

Measurements.—Type: Total length, 220; tail vertebræ, 108; hind foot, 25. An adult topotype: 234; 116; 29. Average of three adults from Catemaco, Vera Cruz: 229 (225–234); 115 (109–122); 29 (28–29). *Skull* (average of three adults): Greatest length, 31.8 (31.4–32.2); zygomatic breadth, 15.6 (15.3–16); interorbital breadth, 7.8 (7.7–7.9); length of nasals, 13.2 (12.7–13.5); width of braincase, 14.5 (14.4–14.8); alveolar length of upper molar series, 4.8 (4.4–5.2).

Remarks.—This dark, strongly characterized form connects *isthmius* and *obscurus.* In some of the specimens from Santo Domingo and Guichicovi, Oaxaca, the skulls are more slender and show gradation toward *isthmius,* which inhabits the more arid area to the southward. Specimens from Otatitlan are nearest to *obscurus,* but show an approach to *veræcrucis* in dark edged forearms (pure white in *obscurus*) and the heavier maxillæ of some skulls.

"*L. orbitalis*" was based on a specimen with strongly developed skull from near the type locality of *veræcrucis.* Its characters appear to be within the range of individual variation in the subspecies *veræcrucis.*

Specimens examined.—Total number 34, from the following localities:

Vera Cruz: San Andres Tuxtla (type locality), 3; Catemaco, 8; Santiago Tuxtla, 1.

Oaxaca: Guichicovi, 7; Laguna, 1; Santo Domingo, 14.

LIOMYS PICTUS OBSCURUS Merriam.

CARRIZAL SPINY POCKET MOUSE.

Liomys obscurus Merriam, Proc. Biol. Soc. Wash., XV, p. 48, Mar. 5, 1902.

Heteromys paralius Elliot, Pub. Field Columb. Mus., Zool. ser., III, No. 13, p. 233, June, 1903. From San Carlos, Vera Cruz, Mexico. Type in Field Columbian Museum, collected by N. G. Buxton.

Type locality.—Carrizal, Vera Cruz, Mexico. Type No. 108563, ♀ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, May 12, 1901.

Distribution.—Arid coastal plains in south-central Vera Cruz, Mexico. Arid Tropical Zone.

General characters.—Size similar to *pictus*, but hind foot averaging slightly longer; color less tawny; lateral line narrower; maxillary root of zygoma weakly developed; hind foot six-tuberculate. Nearest geographically to and intergrading with *veræcrucis*, but differing in paler color and much less massive skull.

Color.—*Fresh pelage:* Upperparts mouse gray (varying in worn pelage to blackish slate), heavily grizzled with orange buffy; underparts, forelegs, and hind feet white; lateral line orange buffy, broad and distinct along cheeks and sides of neck, narrow and inconspicuous from shoulders to hind legs; tail dusky above, white below.

Cranial characters.—Skull similar in general to that of *pictus*, but nasals broader, more expanded anteriorly, emarginate posteriorly (truncate in *pictus*); sides of rostrum more nearly parallel, broadening more abruptly to zygomata. Most like *veræcrucis*, but less massive, narrower across anterior roots of zygomata; rostrum more slender, and sides more nearly parallel, broadening more abruptly posteriorly to zygomata; ascending branches of premaxillæ narrower; maxillary root of zygoma much less strongly developed.

Measurements.—Type: Total length, 238; tail vertebræ, 124; hind foot, 31. An adult topotype: 242; 128; 31. An adult from Santa Maria, Vera Cruz: 238; 117; 31. *Skull* (average of two adult topotypes): Greatest length, 32.1 (32–32.1); zygomatic breadth, 14.8 (14.4–15.3); interorbital breadth, 7.2 (7.1–7.4); length of nasals, 13.3 (13.2–13.4); width of braincase, 14 (13.9–14.1); alveolar length of upper molar series, 4.9.

Remarks.—The range of this subspecies marks the northern limit of the *pictus* group in eastern Mexico. In southern Vera Cruz it merges with that of *veræcrucis*. Specimens from Otatitlan are intermediate, but apparently nearer *obscurus*. They approach *veræcrucis* in general color, including the dark edging of forearms, but in cranial characters agree closely with *obscurus*.

The so-called *H. paralius*, from San Carlos, on the Gulf coast a few miles from the type locality of *obscurus*, appears to be based on typical specimens of the latter form.

Specimens examined.—Total number 11, from localities as follows:

Vera Cruz: Carrizal (type locality), 2; Otatitlan, 5; San Carlos, 1; Santa Maria, 3.

LIOMYS ANNECTENS (Merriam).

PLUMA SPINY POCKET MOUSE.

Heteromys annectens Merriam, Proc. Biol. Soc. Wash., XV, p. 43, Mar. 5, 1902.

Type locality.—Pluma, Oaxaca, Mexico. Type No. 71510, ♂ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, March 18, 1895.

Distribution.—Pacific slopes of Sierra Madre in Oaxaca and Guerrero, Mexico. Humid Tropical Zone.

General characters.—Size largest of the *pictus* group; orange buff lateral line conspicuous; sole of hind foot thinly haired posteriorly, six-tuberculate. Similar in general to *phæurus* and *rostratus*, but decidedly larger than either.

Color.—*Fresh pelage:* Upperparts dark mouse gray, the intermixed, slender, orange buffy hairs scarcely numerous enough to affect the general tone; lateral line from cheeks to outer sides of hind legs and along base of tail rich orange buff; underparts and feet pure white; ears dusky, sometimes faintly edged with whitish; tail dusky above, whitish below, becoming darker near tip.

Cranial characters.—Skull most like that of *phæurus*, but decidedly larger; rostrum relatively rather slender, usually broadening more abruptly posteriorly; interparietal subtriangular, the anterior angle well developed, as in *phæurus* (interparietal more oval in *rostratus*).

Measurements.—Type: Total length, 300; tail vertebræ, 165; hind foot, 33. Average of four adults from type locality: 281; 156; 32. *Skull* (average of two adult topotypes): Occipito-nasal length, 34.1 (34–34.2); zygomatic breadth, 16.3 (16.2–16.4); interorbital breadth, 8.2 (7.9–8.5); length of nasals, 14.7 (14.4–15.1); width of braincase, 14.4 (14.4–14.5); alveolar length of upper molar series, 5.2.

Remarks.—*L. annectens* is a member of the *pictus* group allied to *phæurus* and *rostratus*, but distinguished by larger size. It inhabits the humid, heavily forested upper slopes on the Pacific side of the Sierra Madre in Oaxaca and Guerrero; its geographic range parallels those of *rostratus* and *phæurus*, which lie along the more arid basal slopes of the mountains nearer the coast.

Specimens examined.—Total number 12, from the following localities:

Oaxaca: Pluma (type locality), 6.
Guerrero: Omilteme, 6.

LIOMYS CRISPUS GROUP.

LIOMYS CRISPUS Merriam.

Tonala Spiny Pocket Mouse.

(Pl. III, figs. 3, 3*a*.)

Liomys crispus Merriam, Proc. Biol. Soc. Wash., XV, p. 49, Mar. 5, 1902.

Type locality.—Tonala, Chiapas, Mexico. Type No. 75105, ♂ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, August 7, 1895.

Distribution.—Coastal plains and lower foothills of the Sierra Madre in western Chiapas, Mexico. Arid Tropical Zone.

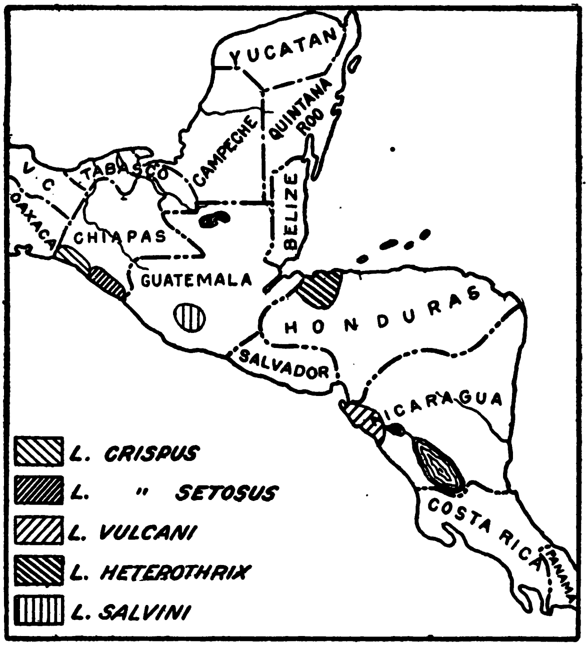


Fig. 5.—Distribution of *Liomys crispus* and allied forms.

General characters.—Size small; tail about equal to head and body, thinly haired, indistinctly bicolor; ears small; hind foot six-tuberculate, the sole hairy from heel to posterior tubercle; color brownish gray; ears not edged with whitish; lateral line absent; slender hairs over dorsal area standing out conspicuously beyond bristles.

Color.—*Fresh pelage:* Upperparts drab and hair brown, resulting from intermixed dusky tipped bristles and slender pale gray hairs, the general color darkest over median dorsal area; underparts, fore limbs, and hind feet creamy white; ears dusky; tail dusky above, becoming paler below, without sharp line of demarcation.

Cranial characters.—Skull small and slender; rostrum rather short; nasals not expanded anteriorly, the sides nearly parallel; ascending branches of premaxillæ slender, nearly conterminous posteriorly with nasals; supraorbital ridges weakly developed; interparietal irregularly oval, with very small posterior emargination; dentition much as in *L. pictus*, but crown of first upper molar more quadrate, never forming central enamel island by union through wear of ends of enamel loops; first upper molar with small inner and outer reentrant angles, due to closure of median sulcus, persisting until after formation of enamel islands in second and third molars (disappearing in *pictus*, at least on inner side, earlier in life).

Measurements.—Type: Total length, 210; tail vertebræ (tip gone), 99; hind foot, 27.5. Average of six adult topotypes: 216 (208–220); 108 (104–112); 26.7 (26–27). *Skull* (average of 4 adults): Greatest length, 31.5 (30.1–31.9); zygomatic breadth, 14.4 (14.1–14.8); interorbital breadth, 6.4 (6.3–6.7); length of nasals, 11.9 (11.4–12.5); width of braincase, 13.4 (13.1–13.7); alveolar length of upper molar series, 4.8 (4.5–4.9).

Remarks.—*Liomys crispus* with *setosus*, *heterothrix*, and probably *salvini* and *nigrescens*, comprise a group characterized by small size, short tail, and peculiar pelage and dental characters. Over the dorsal surface the slender hairs stand out much more conspicuously beyond the bristles than is usual in the genus. Owing to slight depth the transverse sulcus in the crown of the first upper molar disappears through wear without leaving a central enamel island, the loops uniting first near the inner side, as usual in the genus, but obliteration progressing more rapidly outward.

Specimens examined:

Chiapas: Tonala (type locality), 18.

LIOMYS CRISPUS SETOSUS Merriam.

Huehuetan Spiny Pocket Mouse.

Liomys crispus setosus Merriam, Proc. Biol. Soc. Wash., XV, p. 49, Mar. 5, 1902.

Type locality.—Huehuetan, Chiapas, Mexico. Type No. 77588, ♀ old adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, February 22, 1896.

Distribution.—Forested coastal plains and basal slopes of Sierra Madre in southern Chiapas, Mexico. Humid Tropical Zone.

General characters.—Similar in size to *crispus*, but hind foot relatively longer; color decidedly darker; skull slightly larger.

Color.—*Partly worn pelage:* Upperparts grayish slate, darkest over median dorsal area; underparts, fore limbs, and hind feet creamy white; ears blackish; tail dusky above, dull whitish below.

Cranial characters.—Skull resembling that of *crispus*, but larger and heavier; nasals longer, the sides nearly parallel, as in *crispus;* premaxillæ reaching posteriorly well beyond nasals (nearly conterminous with nasals in *crispus*).

Measurements.—Type: Total length, 225; tail vertebræ, 110; hind foot, 29. Average of five adult topotypes: 213 (208–225); 104 (97–110); 28.8 (28–30). *Skull* (average of two adults): Greatest length, 32.2; zygomatic breadth, 14.9 (14.6–15.3); interorbital breadth, 6.9 (6.4–7.2); length of nasals, 12.8 (12.7–12.9); width of braincase, 14 (13.5–14.6); alveolar length of upper molar series, 4.8.

Remarks.—The darker color of this subspecies, compared with *crispus*, is probably due to the more humid, heavily forested character of the region it inhabits. The slender hairs among the bristles over dorsum are less numerous in the specimens examined than in *crispus*, but this may be a result of greater wear.

Mr. Gerrit S. Miller, jr., has compared for me topotype material of *setosus* with the type of *salvini*. His notes indicate rather close relationship, but the latter is "distinctly tawny," while the former shows no trace of this color.

Specimens examined:

Chiapas: Huehuetan (type locality), 14.

LIOMYS VULCANI (Allen).

Volcan Spiny Pocket Mouse.

Heteromys vulcani Allen, Bull. Amer. Mus. Nat. Hist., XXIV, p. 652, Oct. 13, 1908.

Type locality.—Volcan de Chinandega (altitude about 4,000 feet), Nicaragua. Type No. 28315, ♀ adult, American Museum of Natural History, New York, collected by W. B. Richardson, May 7 (date of original tag), 1907.

Distribution.—Vicinity of the type locality in the mountains of extreme western Nicaragua.

General characters.—Closely allied to *L. c.* **setosus**, but smaller; color very similar, but slender hairs slightly more buffy; hind foot normally six-tuberculate, the sole thinly haired posteriorly; interparietal usually without the small posterior emargination present in *setosus*.

Color.—*Partly worn pelage:* Upperparts grayish slate, varying to blackish over median dorsal area, the slender hairs more buffy than in *setosus*, but scarcely altering the general color; underparts white; forelegs and hind feet usually nearly pure white (feet rather distinctly clouded with dusky in one specimen); ears blackish, faintly edged with whitish; tail dusky above, whitish below.

Cranial characters.—Skull closely resembling that of *setosus*, but decidedly smaller; ascending branches of premaxillæ reaching posteriorly beyond nasals as in *setosus* (not conterminous with nasals as in *crispus*); posterior border of interparietal more evenly convex as in *heterothrix* (usually without the small median emargination present in *setosus*); dentition as in the other members of the *crispus* group.

Measurements.—Type: Total length, 220; tail, 110; hind foot, 25 (collector's measurements in original description). *Skull* (type): Greatest length, 31; interorbital breadth, 6.9; length of nasals, 11.7; width of braincase, 13.4; alveolar length of upper molar series, 5. Average of two adult topotypes: Greatest length, 30.6; zygomatic breadth, 14.2; interorbital breadth, 6.9; length of nasals, 12.3; width of braincase, 13.4; alveolar length of upper molar series, 4.8.

Remarks.—*L. vulcani* is a member of the *crispus* group, closely allied to *setosus*. It may be not very unlike *salvini* and *nigrescens*, the types of which I have not seen. In some specimens of *vulcani* the forearms are pure white; in others a few inconspicuous dark hairs are scattered along the forearms. One specimen has the feet clouded with dusky, as already noted. The original description of *salvini* mentions "a narrow slaty-gray edging" of forearm which seems scarcely applicable to *vulcani*. The slender hairs protrude from among the bristles over dorsum as in *crispus* and are more buffy, but not the ochraceous buff which in *heterothrix* affects the general color. In cranial characters *vulcani* is nearer to *setosus* than to *heterothrix*. In one of the topotypes the interparietal is divided longitudinally by a suture, which is nearly continuous with the median suture between parietals.

Specimens examined:

Nicaragua: Volcan de Chinandega (type locality), 6.

LIOMYS HETEROTHRIX Merriam.

Honduras Spiny Pocket Mouse.

Liomys heterothrix Merriam, Proc. Biol. Soc. Wash., XV, p. 50, Mar. 5, 1902.

Type locality.—San Pedro Sula, Honduras. Type No. 90161, ♂ adult, United States National Museum (Biological Survey collection), collected by J. C. Ingersoll, July 16, 1897.

Distribution.—Known only from the type locality, on the Chamelicon River, near the coast of northwestern Honduras.

General characters.—Size slightly larger than *L. c. setosus;* tail about equal to head and body, thinly haired, indistinctly bicolored; slender hairs tipped with ochraceous buff; forearms entirely white, without trace of "slaty-gray edging" of *H. salvini;*[1] ears faintly edged with whitish; hind foot six-tuberculate.

Color.—*Fresh pelage:* Upperparts between drab and hair brown, tinged with ochraceous buff by outstanding slender hairs; underparts, forelimbs, and feet creamy white; tail dusky above, paler below.

Cranial characters.—Skull similar in size and general form to that of *L. c. setosus*; nasals more wedge-shaped, tapering posteriorly; ascending branches of premaxillæ broader, reaching posteriorly beyond nasals, as in *setosus;* maxillary root of zygoma narrower and weaker, owing to greater anterior development of frontal along intermaxillary suture; interparietal more evenly oval, without small posterior emargination present in *setosus* and *crispus;* dentition as in *crispus*.

Measurements.—Type: Total length, 255; tail vertebræ, 126; hind foot, 31. Average of six adult topotypes: 227 (210–255); 110 (100–126); 27.5 (25–31). *Skull* (average of four adults): Greatest length,

---

[1] See Thomas, Ann. Mag. Nat. Hist., ser. 6, XI, p. 331, 1893.

32.2 (29.9–34.7); zygomatic breadth, 14.8 (13.1–16.4); interorbital breadth, 6.9 (6.5–7.5); length of nasals, 13 (12–14); width of braincase, 13.7 (13.2–14.7); alveolar length of upper molar series, 4.8 (4.6–5).

Remarks.—The differences separating *heterothrix* from *crispus* and *setosus* are well marked, but its exact relationship to *salvini*, the type of which I have not personally examined, is somewhat problematical. The notes furnished by Mr. Gerrit S. Miller, jr., who has compared for me topotypes of both *heterothrix* and *setosus* with the type of *salvini*, seem to show that the latter is nearest to *setosus*, though differing rather decidedly in color, and in this respect approaching *heterothrix*.

Specimens examined:

Honduras: San Pedro Sula (type locality), 20.

LIOMYS SALVINI (Thomas).

SALVIN SPINY POCKET MOUSE.

Heteromys salvini Thomas, Ann. Mag. Nat. Hist., ser. 6, XI, pp. 331–332, 1893.

Type locality.—Dueñas, Guatemala. Type in the British Museum, collected by O. Salvin, July 31, 1873.

Distribution.—Vicinity of the type locality.

General characters.—Size small; general coloration rather dark. Similar to *L. c. setosus*, but upperparts tawny (slaty in *setosus*); outer side of forearm "with a narrow slaty-gray edging" (absent in *setosus*); hind foot shorter, the sole, as in *setosus*, hairy posteriorly and six-tuberculate.

Color.—From original description: "General colour blackish, rather darker than in most of the other species, grizzled with yellowish on the back. Lower surface pure white, as usual. Outer sides of forearm with a slaty-grey edging, more conspicuous than in *H. alleni* and *bulleri*, less than in *H. longicaudatus* * * * posterior half of sole [hind foot] covered with short brownish hairs * * *. Tail thinly haired, bicolor, but not so sharply and decidedly as usual, brown above, whitish below."

Cranial characters.—Skull apparently nearest to that of *L. c. setosus*, but slightly larger.

Measurements.—Type (from original description): Head and body, 115; tail (imperfect at tip), 95 + ?; hind foot, 26.5. *Skull* (type measured by Gerrit S. Miller, jr.): Greatest length, 33; zygomatic breadth, 15; interorbital breadth, 7; length of nasals, 13; alveolar length of upper molar series, 5.

Remarks.—Mr. Gerrit S. Miller, jr., has compared for me the type of *salvini* with topotypes of *setosus* and *heterothrix* and specimens of other small forms occurring in southern Mexico. His comparative notes seem to indicate nearest relationship to *setosus*, but he describes the back of the type of *salvini* as "distinctly tawny," of which color there is no trace in *setosus*. The skulls agreed very closely. The "slaty-gray" edged outer sides of forearms mentioned in the original description of *salvini* is another character not shared with *setosus* or *heterothrix*.

LIOMYS SALVINI NIGRESCENS (Thomas).

BLACK SPINY POCKET MOUSE.

Heteromys salvini nigrescens Thomas, Ann. Mag. Nat. Hist., ser. 6, XII, p. 234, 1893.

Type locality.—Costa Rica. Type in British Museum, No. 69. 7. 19.6.

General characters.—Size very small—still smaller than *salvini;* color darker; no yellowish lateral line.

Color.—From original description: "Colour very similar to that of *H. S. typicus*, but yellowish grizzling on the back, inconspicuous in that animal, is entirely absent, at least along the mesial line, so that the dorsal colour is a deep uniform smoky brown. Towards the sides a few yellow-tipped hairs are present, but not in sufficient numbers to affect the general tone. No trace of a yellowish lateral line. Limbs as in *H. S. typicus*."

Cranial characters.—From original description: "Skull decidedly smaller and more delicate than in the typical form, the muzzle more slender, the interorbital region narrower, and the interparietal conspicuously smaller (its length-breadth percentage 51)."

Measurements.—Type: "Head and body, 127; tail broken; hind foot, without claws, 25." *Skull:* Greatest length, 32.7; zygomatic breadth, 15.2; interorbital breadth, 6.6; length of nasals, 13.2; alveolar length of upper molar series, 5.

Remarks.—This form, as nearly as can be determined from the original description and comparisons made for me by Mr. Miller, appears to belong with *salvini* to the *crispus* group. Comparing the skull of the type with *setosus* of the same group, Mr. Miller says: "Teeth and skull the same, but with audital bullæ slightly flatter and not quite as large. Interparietal slightly smaller, but of similar shape."

LIOMYS ADSPERSUS (Peters).

PANAMA SPINY POCKET MOUSE.

Heteromys adspersus Peters, Monatsber. K. Preuss. Akad. Wissensch., Berlin, pp. 356–359, with pl., May, 1874.

Type locality.—"Panama." Type, ♂ young (mounted), in Berlin Museum.

Distribution.—Range unknown.

General characters.—Size medium; upperparts dark bluish drab, or dark gray, slightly speckled with ochraceous buff; entire forelegs white; hind feet naked posteriorly, six-tuberculate.

Color.—General color of upperparts dark bluish drab, or dark gray, the back slightly speckled by ochraceous buffy hairs; underparts pure creamy white; feet and forelegs white, the drab of sides extending along outer surface of hind legs to heels; ears faintly edged with whitish; tail thinly haired, coarsely annulated, indistinctly bicolored, brownish above, white below.

Cranial characters.—From original description: Upper incisors darker anteriorly than the lower, which are narrower and brighter yellow; upper premolar with three enamel loops, the anterior longer and narrower, the posterior shorter and broader, and both diverging internally to admit between them the third and smallest, which is egg-shaped; first upper molar with a deep inner and a shallow outer reentrant angle; third upper molar with an enamel pattern similar to that of second, but posterior loop noticeably narrower than anterior. Rostrum narrow, the nasals and premaxillæ projecting, as in allied species, far over the incisors, and premaxillæ forming in front sharp vertical ridges. The small incisive foramina, lachrymals, and interorbital foramina closely resemble those of *Geomys*. The frontals form, as in *Mus*, sharp supraorbital ridges which are continued across the parietals and bound a plane surface, with the interparietal, twice as long as broad, attached posteriorly, while the temporal fossæ are deepened. The under jaw closely resembles that of *Perognathus* in the shape of the coronoid and angular processes; the deep fossa which in *Geomys* extends outward from the posterior molar is entirely absent.

Measurements.—Dry skin of type (from original description): Head and body, 145; tail, 95; hind foot, 30. *Skull:* No measurements available.

Remarks.—The type of *H. adspersus* Peters I have not examined, but Peters's full description and plate illustration of cranial and dental characters, together with notes kindly made for me by Mr. Gerrit S. Miller, jr., seem to indicate that the species belongs to the genus *Liomys*, but differs from all the other known members in having the soles of hind feet naked posteriorly. The dental characters shown by the plate are those of an immature individual with permanent premolars in place, but very slightly worn. The teeth in some respects approach those of *L. heterothrix* of similar age, and the two species may prove to be related. From *repens*, a spiny pocket mouse of the genus *Heteromys* inhabiting the same general region, *adspersus* may be known externally by the white instead of dusky outer sides of forelegs; and the skull differs notably in narrower, more constricted frontal region and in the apparent absence of additional enamel islands in the posterior lobes of all the upper molariform teeth.

LIOMYS IRRORATUS GROUP.

LIOMYS IRRORATUS (Gray).

OAXACA SPINY POCKET MOUSE.

(Pl. III, figs. 5, 5*a*.)

Heteromys irroratus Gray, Proc. Zool. Soc. Lond., p. 205, 1868.

Heteromys albolimbatus Gray, Proc. Zool. Soc. Lond., p. 205, 1868. From La Parada, Oaxaca, Mexico. Cotypes (2) in British Museum, probably collected by Boucard for Sallé.

Type locality.—State of Oaxaca, Mexico. Type in British Museum, probably collected by Boucard for Sallé near the city of Oaxaca.[1] Specimens from the city of Oaxaca are considered typical.

Distribution.—High interior plains and lower mountain slopes in central and eastern Oaxaca, Mexico. Lower Sonoran and Humid Tropical Zones.

General characters.—Size rather large; tail slightly longer than head and body, well haired, sharply bicolor; color grizzled gray; lateral line faint; ears distinctly edged with white; sole of hind foot hairy posteriorly, five-tuberculate.

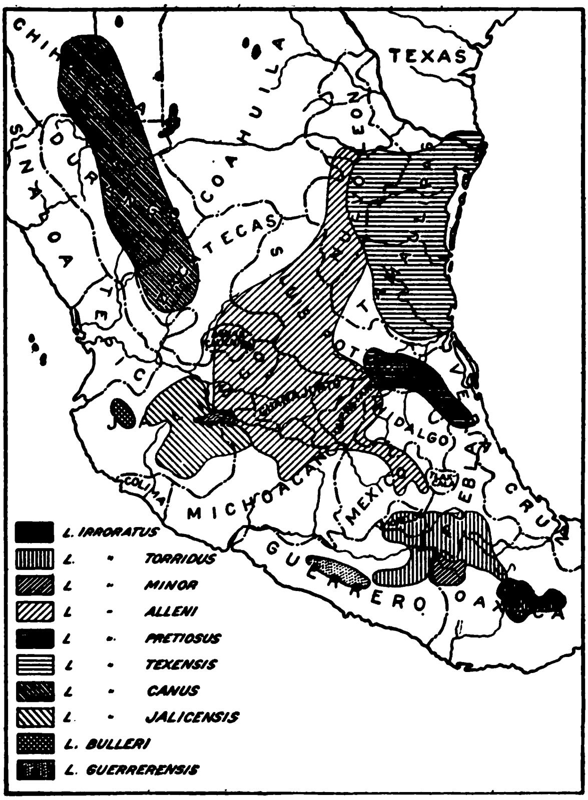


FIG. 6.—Distribution of *Liomys irroratus* and allied forms.

Color.—Fresh pelage: Upperparts mouse gray, darkest, and in some specimens more or less mixed with blackish on top of head and back, thinly grizzled with ochraceous buffy hairs; underparts and feet white; ochraceous buffy lateral line absent or usually inconspicuous;

---

[1] For localities worked by Boucard in this region see Sclater, Proc. Zool. Soc. Lond., p. 295, 1858; ibid., 1859, pp. 369–370.

outer sides of forearms varying from nearly pure white to distinctly grayish; ears blackish edged with whitish; tail dusky above, whitish below, except tip, which is dark all round.

Cranial characters.—Skull large and rather heavy, relatively short and broad, with slender rostrum and widely spreading zygomata; supraorbital ridges rather weakly developed, as usual in the genus *Liomys;* sagittal area very wide; interparietal broadly oval; bullæ large and inflated; dentition heavy; anterior molars nearly as broad as premolars; posterior molars very small and cylindrical; tubercle over root of lower incisor well developed. Similar in general to that of *guerrerensis*, but less massive; rostrum much more slender; premaxillæ narrower; frontals narrower; maxillary root of zygoma less heavy. Compared with *bulleri*, the skull differs mainly in narrower frontal region and decidedly larger, broadly oval instead of triangular interparietal.

Measurements.—Average of six adults from Oaxaca, Oaxaca: Total length, 273 (258–295); tail vertebræ, 148 (132–163); hind foot, 32.3 (31–35). *Skull* (average of same): Greatest length, 33.2 (31.5–34.9); zygomatic breadth, 15.8 (15–17.1); interorbital breadth, 8 (7.7–8.3); length of nasals, 14.1 (13.2–14.9); width of braincase, 14.9 (14.3–15.6); alveolar length of upper molar series, 5.2 (4.9–5.5).

Remarks.—Specimens in the collection of the Biological Survey from various localities in Oaxaca have been compared for me by Mr. Gerrit S. Miller, jr., with the types of *irroratus* and *albolimbatus* in the British Museum. Those from the city of Oaxaca were found to agree closely with both, and in Mr. Miller's opinion *irroratus* and *albolimbatus* represent the same species. His comparative notes appear to justify this conclusion. Alston has shown[1] that the type of *albolimbatus* probably came to the British Museum through Sallé. Boucard made collections for Sallé at La Parada (type locality of *albolimbatus*), altitude about 7,900 feet, on a mountain slope 15 miles northeast of the city of Oaxaca; also at San Miguel de Peras, a few miles southwest of the same city. As no exact locality was given for the type of *irroratus* which was obtained through Sallé from the "State of Oaxaca," it seems probable that it also was collected by Boucard at the same place as *albolimbatus* or elsewhere in the vicinity of the city of Oaxaca.

L. irroratus is typical of a group, most of the members of which are closely related and range over nearly the whole of the Mexican tableland region. The group belongs mainly to the Sonoran Zones, but several representatives reach a short distance into the Arid and Humid Tropical Zones.

Specimens examined.—Total number 30, from localities as follows:

Oaxaca: Oaxaca, 22; Cerro San Felipe, 2; Mount Zempoaltepec, 5; Yalalag, 1.

---

[1] Biol. Centrali-Amer., Mamm., p. 167, 1879–1882.

LIOMYS IRRORATUS TORRIDUS Merriam.

TORRID SPINY POCKET MOUSE.

Liomys torridus Merriam, Proc. Biol. Soc. Wash., XV, p. 45, Mar. 5, 1902.
Heteromys exiguus Elliot, Pub. Field Columb. Mus., Zool. ser., III, pp. 146–147, Feb., 1903. From Puente de Ixtla, Morelos, Mexico. Type in Field Columbian Museum.

Type locality.—Cuicatlan, Oaxaca, Mexico. Type No. 69645, ♀ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, October 14, 1894.

Distribution.—Arid interior plains and valleys, from northern Oaxaca and southern Puebla west through Morelos and eastern Guerrero to Chilpancingo. Arid Tropical and lower part of Lower Sonoran Zones.

General characters.—Closely allied to *irroratus* and *alleni*, but smaller; outer sides of forearms less grayish (usually pure white); hind foot five-tuberculate as in *irroratus*.

Color.—As in *irroratus*, except outer sides of forearms, which are pure white or faintly edged with grayish.

Cranial characters.—Skull closely resembles that of *irroratus*, but averages much smaller, with nasals less deeply emarginate (sometimes truncate) posteriorly. Differs from *alleni* mainly in decidedly smaller size and less squarely truncate nasals.

Measurements.—Type: Total length, 242; tail vertebræ, 134; hind foot, 28. Average of 10 adult topotypes: 242 (227–252); 139 (129–143); 28.1 (27–29). *Skull* (average of 10 adults): Greatest length, 30.7 (29.9–32.1); zygomatic breadth, 14.2 (14–14.8); interorbital breadth, 7.7 (7.4–8.2); length of nasals, 12.3 (11.9–12.8); width of braincase, 13.4 (12.9–14); alveolar length of upper molar series, 4.5 (4.3–4.9).

Remarks.—This small form is nearly related to *irroratus* and *alleni* and connects them geographically. Its fairly well-defined range includes lower, hotter areas than those of *irroratus* or *alleni*, but complete intergradation seems certain. Specimens of *irroratus* from the city of Oaxaca show a large amount of individual variation, and the smallest are only slightly larger than typical *torridus* and agree otherwise very closely with it. Those from higher parts of the plateau region in and near the Valley of Mexico are apparently nearest to *alleni*, but present variable characters and in some respects approach *torridus*.

Topotypes of *H. exiguus* Elliot are nearly typical *torridus*.

Specimens examined.—Total number 109, from the following localities:

Oaxaca: Cuicatlan (type locality), 37.
Guerrero: Ayusinapa, 1; Chilpancingo, 5; Tlapa, 5.
Morelos: Cuernavaca, 8; Puente de Ixtla, 4; Yautepec, 22.
Puebla: Acatlan, 2; Amolac, 2; Atlixco, 5; Piaxtla, 17; Tehuacan, 1.

LIOMYS IRRORATUS MINOR Merriam.

HUAJUAPAM SPINY POCKET MOUSE.

Liomys torridus minor Merriam, Proc. Biol. Soc. Wash., XV, p. 45, Mar. 5, 1902.

Type locality.—Huajuapam, Oaxaca, Mexico. Type No. 70301, ♀ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, November 18, 1894.

Distribution.—Elevated plains of northwestern Oaxaca and northeastern Guerrero, Mexico. Arid Tropical and Lower Sonoran Zones.

General characters.—Size smallest of the *irroratus* group. Most like *torridus*, but still smaller; hind foot five-tuberculate. Differs from *irroratus* in decidedly smaller size.

Color.—As in *torridus*.

Cranial characters.—Skull similar to that of *torridus*, but smaller; braincase more arched; rostrum heavier posteriorly, broadening more gradually to zygomata; nasals shorter, squarely truncate posteriorly.

Measurements.—Type: Total length, 222; tail vertebræ, 125; hind foot, 27. *Skull:* Greatest length, 29; zygomatic breadth, 14.2; interorbital breadth, 13; length of nasals, 11.7; width of braincase, 13.9; alveolar length of upper molar series, 4.6.

Remarks.—*L. i. minor* appears to be a rather localized form. Specimens from northeastern Guerrero seem to show intergradation with *torridus*.

Specimens examined.—Total number 7, from the following localities:

Oaxaca: Huajuapam (type locality), 4; Tlapancingo, 1.
Guerrero: Sochi, 1; Tlalixtaquilla, 1.

LIOMYS IRRORATUS ALLENI (Coues).

ALLEN SPINY POCKET MOUSE.

(Pl. I, figs. 3, 3*a*, 3*b*; Pl. III, figs. 4, 4*a*.)

Heteromys alleni Coues, Bull. Mus. Comp. Zool., VIII, pp. 187–189, 1881.

Type locality.—Rio Verde, San Luis Potosi, Mexico. Type No. 5889, ♂ adult, Museum of Comparative Zoology, collected by Dr. Edward Palmer, February 26, 1878.

Distribution.—Eastern and southern portions of Mexican tableland region from Monterey, Nuevo Leon, to the Valley of Mexico and as far west as Chicalote, Aguas Calientes, and Ocotlan, Jalisco. Upper and Lower Sonoran Zones.

General characters.—Similar to *irroratus*, but smaller; color and external appearance about the same; lateral line rather faint; tail relatively shorter, about equal to head and body; hind foot five-tuberculate. Similar to *pretiosus*, *jalicensis*, and *torridus*, but larger.

Closely related to *canus*, but smaller. Differs from *texensis* in larger size and grayer color.

Color.—As in *irroratus*.

Cranial characters.—Skull similar in general to that of *irroratus*, but nasals truncate instead of emarginate posteriorly; rostrum heavier; frontals broader; interparietal slightly smaller. Closely related to *jalicensis* and *torridus*, but larger, with more squarely truncate nasals. Similar to *texensis*, but larger, with relatively narrower frontals, and larger, broader, less evenly oval interparietal. Compared with *pretiosus* the skull is decidedly larger with rostrum less inflated anteriorly; premaxillæ less bulging over incisors; nasals relatively narrower anteriorly. Differs from *canus* mainly in smaller size and narrower frontals.

Measurements.—Average of two adult topotypes: Total length, 257; tail vertebræ, 137; hind foot, 32.7. Average of five adults from Ahualulco, San Luis Potosi: 254 (249–257); 126 (121–132); 31.6 (31–32). *Skull* (average of four adults): Greatest length, 34.5 (34–35.2); zygomatic breadth, 16.7 (16.1–17.1); interorbital breadth, 8.7 (8.5–9); length of nasals, 14.2 (13.9–14.6); width of braincase, 15.4 (14.9–15.8); alveolar length of upper molar series, 5.6 (5.3–6).

Remarks.—*L. i. alleni* is a widely distributed, central subspecies whose range is nearly or entirely surrounded by those of closely related forms. Specimens from Monterey, Nuevo Leon, agree with the typical form in color, and in breadth and shape of interparietal, but are smaller and apparently grading toward *texensis*. At lower elevations to the eastward of the type locality *alleni* passes into *pretiosus*, as shown by specimens of the latter form from Valles, San Luis Potosi, and from Jalpan, Queretaro. Specimens from Querendaro and Patzcuaro, Michoacan, and in and near the Valley of Mexico are variable and appear to be approaching *torridus*. On the west and northwest *alleni* intergrades with *jalicensis* and *canus*.

Specimens examined.—Total number 107, from the following localities:

San Luis Potosi: Rio Verde (type locality), 12; Ahualulco, 6; Hacienda la Parada, 3; Jesus Maria, 2; Villar, 15.
Aguas Calientes: Chicalote, 1.
Federal District: Tlalpam, 3.
Guanajuato: Acambaro, 1; Silao, 8.
Hidalgo: Marques, 2; Tula, 2; Zimapan, 3.
Jalisco: Ocotlan, 15.
Michoacan: Patzcuaro, 1; Querendaro, 5.
Nuevo Leon: Cerro de la Silla, 1; Monterey, 9.
Puebla: San Martin, 4.
Queretaro: Pinal de Amoles, 5; Tequisquiapan, 1.
Tamaulipas: Jaumave, 1; Miquihuana, 3.
Zacatecas: Berriozabel, 4.

LIOMYS IRRORATUS PRETIOSUS subsp. nov.

METLALTOYUCA SPINY POCKET MOUSE.

Type from Metlaltoyuca, Puebla, Mexico. No. 93097, ♂ adult, United States National Museum (Biological Survey collection), collected by E. A. Goldman, January 25, 1898. Original No. 12081.

Distribution.—Humid basal mountain slopes in extreme eastern San Luis Potosi, northern Queretaro, eastern Puebla, and northern Vera Cruz, Mexico. Humid Tropical Zone.

General characters.—Similar to *alleni*, but color slightly darker; lateral line more distinct; cranial characters pronounced; hind foot five-tuberculate. Somewhat like *texensis*, but much darker, ochraceous buffy hairs less conspicuous.

Color.—*Fresh pelage:* Upperparts dark mouse gray, mixed with blackish on median dorsal area, thinly grizzled with ochraceous buffy hairs; underparts and feet white; lateral line pale ochraceous buffy, usually distinct from cheeks to hind legs; outer sides of forelegs grayish, interrupted by buffy lateral line; tail dusky above, white below, except tip, which is dark all around.

Cranial characters.—Skull rather small, with short, anteriorly expanded rostrum and very narrow frontals. Similar in general to that of *alleni*, but decidedly smaller; anterior nares much more inflated; rostrum narrower posteriorly, the sides more nearly parallel; nasals relatively broader anteriorly, slightly emarginate posteriorly; frontals much narrower. Compared with *texensis* the skull is less massive; anterior nares more inflated; rostrum narrower posteriorly; frontal region much narrower, more constricted; premaxillæ reaching farther posteriorly beyond nasals; interparietal much broader transversely and less evenly oval.

Measurements.—Type: Total length, 263; tail vertebræ, 145; hind foot, 34. Average of five adult topotypes, 246 (239–263); 133 (127–145); 32.6 (31.5–34). *Skull* (type): Greatest length, 32.5; zygomatic breadth, 15.2; interorbital breadth, 7.5; length of nasals, 13.2; width of braincase, 14.6; alveolar length of upper molar series, 4.9.

Remarks.—In the remarkable inflation of the anterior nares *pretiosus* differs from all the other members of the *irroratus* group. The subspecies appears to be restricted in distribution to the Humid Tropical Zone. Specimens from Valles, San Luis Potosi, and from Jalpan, Queretaro, are nearer to *pretiosus*, but show gradation toward *alleni*, which occupies the higher, Sonoran areas of the table-land region to the westward.

Specimens examined.—Total number 25, from the following localities:

Puebla: Metlaltoyuca (type locality), 7.
Queretaro: Jalpan, 11.
San Luis Potosi: Valles, 3.
Vera Cruz: Papantla, 4.

LIOMYS IRRORATUS TEXENSIS Merriam.

TEXAS SPINY POCKET MOUSE.

Liomys texensis Merriam, Proc. Biol. Soc. Wash., XV, p. 45, Mar. 5, 1902.

Type locality.—Brownsville, Texas. Type No. 58670, ♀ adult, United States National Museum (Biological Survey collection), collected by J. Alden Loring, February 19, 1894.

Distribution.—Low plains from southern Texas to southern Tamaulipas, west in eastern Nuevo Leon to China. Lower Sonoran Zone.

General characters.—Most like *alleni*, but smaller and paler, the slender ochraceous buffy hairs more conspicuous; hind foot five-tuberculate. Similar in size to *pretiosus*, but much paler; differing also in well-marked cranial characters.

Color.—*Fresh pelage:* Upperparts pale mouse gray, darkest on top of head and back, rather conspicuously grizzled with ochraceous buffy hairs; underparts and feet white; lateral line pale ochraceous buffy, usually broad and distinct; outer sides of forearms grayish; tail dusky above, white below, except tip, which is dark all round.

Cranial characters.—Skull similar in general to that of *alleni*, but much smaller; frontals relatively broader; interparietal smaller, narrower, more evenly oval; nasals and premaxillæ more nearly conterminous posteriorly. Compared with *pretiosus* the skull is more massive; rostrum broadening more gradually to zygomata; frontals broader; interparietal much narrower transversely.

Measurements.—Type: Total length, 231; tail vertebræ, 114; hind foot, 30. Average of 10 adult topotypes: 237 (230–257); 122 (114–132); 29.2 (25–32). *Skull* (average of 10 adults): Greatest length, 31.8 (31.1–32.7); zygomatic breadth, 15.6 (14.9–16.4); interorbital breadth, 8.2 (7.8–8.8); length of nasals, 13 (12.2–13.6); width of braincase, 14.3 (13.9–14.8); alveolar length of upper molar series, 4.9 (4.5–5.2).

Remarks.—The range of *texensis* marks the northern limit of the genus along the Gulf coast. Although a well-marked form, it is evidently closely related to *alleni*, which inhabits the more elevated table-land region of the interior, and the two apparently intergrade in the vicinity of Monterey, Nuevo Leon.

Specimens examined.—Total number 91, from the following localities:

Texas: Brownsville (type locality), 42; Lomita Ranch, 4.
Nuevo Leon: China, 1; Montemorelos, 4.
Tamaulipas: Alta Mira, 7; Bagdad, 3; Hidalgo, 2; Matamoros, 18; Soto la Marina, 4; Victoria, 6.

LIOMYS IRRORATUS CANUS Merriam.

CHIHUAHUA SPINY POCKET MOUSE.

Liomys canus Merriam, Proc. Biol. Soc. Wash., XV, pp. 44–45, Mar. 5, 1902.

Type locality.—Near Parral, Chihuahua, Mexico. Type No. 96259, ♂ adult, United States National Museum (Biological Survey collection), collected by Nelson and Goldman, September 21, 1898.

Distribution.—High plains along the eastern base of the Sierra Madre from southern Chihuahua to southern Zacatecas. Upper and Lower Sonoran Zones.

General characters.—Size largest of the *irroratus* group. Most like *alleni*, but larger and slightly paler; lateral line less distinct; hind foot five-tuberculate. Similar to *jalicensis*, but much larger.

Color.—As in *irroratus* and *alleni*, but slightly paler, and lateral line less distinct.

Cranial characters.—Skull very similar to that of *alleni*, but larger, with broader frontals; nasals broader and heavier, truncate posteriorly as in *alleni*. Similar in general to *jalicensis*, but decidedly larger, nasals more squarely truncate posteriorly.

Measurements.—Type: Total length, 276; tail vertebræ, 138; hind foot, 34. Average of three adult topotypes: 262 (247–276); 133 (128–138); 33 (32–34). *Skull* (type): Greatest length, 36.9; zygomatic breadth, 18; interorbital breadth, 9.6; length of nasals, 15; width of braincase, 16.5; alveolar length of upper molar series, 5.5.

Remarks.—The large size of this form usually serves to separate it from *alleni*, to which it is evidently closely related. It appears to be restricted to a rather narrow high area along the east base of the Sierra Madre. Specimens from the city of Durango, Durango, and from San Juan Capistrano, Zacatecas, are smaller than the typical form, but agree in relative breadth of frontal region. Those from Valparaiso, Zacatecas, are nearly typical, although more distant from the type locality.

Specimens examined.—Total number 36, from the following localities.

Chihuahua: Near Parral (type locality), 8; Santa Rosalia, 1.
Durango: Durango, 1; Inde, 5.
Zacatecas: Hacienda San Juan Capistrano, 2; Valparaiso, 19.

LIOMYS IRRORATUS JALICENSIS (Allen).

JALISCO SPINY POCKET MOUSE.

Heteromys jalicensis Allen, Bull. Mus. Nat. Hist. XXII, pp. 251–252, July 25, 1906.

Type locality.—Las Canoas, about 20 miles west of Zapotlan. Jalisco, Mexico (altitude 7,000 feet). Type No. 26325, ♂ young adult, American Museum of Natural History, collected by J. H. Batty, August 6, 1905.

Distribution.—Table-land region of Jalisco and northwestern Michoacan. Mainly Lower Sonoran Zone.

General characters.—Most like *alleni*, but smaller; color the same; hind foot five-tuberculate. Similar to *canus*, but decidedly smaller and slightly darker.

Color.—As in *irroratus* and *alleni*.

Cranial characters.—Skull much like that of *alleni*, but smaller; nasals normally truncated posteriorly as in *alleni*. Differs from *canus* in decidedly smaller size and relatively narrower frontal region.

Measurements.—Type (from original description): Total length, 232; tail vertebræ, 112; hind foot (dry skin), 27.5. Average of three adults from Atemajac (near Guadalajara), Jalisco: 234 (228–238); 119 (117–124); 30 (30–31). *Skull* (average of 5 adult topotypes): Greatest length, 31.9 (31–32); zygomatic breadth, 15.3 (14.4–15.9); interorbital breadth, 8 (7.2–8.8); length of nasals, 12.3 (12–12.5); width of braincase, 14.5 (14.1–14.8); alveolar length of upper molar series, 5.1 (4.9–5.4).

Remarks.—This subspecies is evidently closely related to *alleni*, from which it appears to differ only in smaller size. The difference is constant in specimens examined from widely separated localities in the western part of the plateau region, including most of Jalisco and a part of Michoacan.

Specimens examined.—Total number 37, from the following localities:

Jalisco: Las Canoas (type locality), 10 (including type); Ameca, 9; Arroyo de Gavilan, 3; Atemajac, 8; Etzatlan, 1; Sierra Nevada, 1; Zapotlan, 2.
Michoacan: Zamora, 3.

LIOMYS BULLERI (Thomas).

Buller Spiny Pocket Mouse.

(Pl. III, figs. 6, 6*a*.)

Heteromys bulleri Thomas, Ann. Mag. Nat. Hist., ser. 6, XI, pp. 330–331, Apr., 1893.

Type locality.—La Laguna, Sierra de Juanacatlan, Jalisco, Mexico. Type (♀ adult in alcohol) in British Museum, collected by Dr. Audley C. Buller, December, 1892.

Distribution.—Known only from the type locality in the Sierra de Juanacatlan, Jalisco, Mexico. Upper Sonoran Zone.

General characters.—Size medium; tail slightly longer than head and body; color grayish; lateral line pale ochraceous buff; hind foot five-tuberculate. Size and color about as in *alleni*; cranial characters distinctive.

Color.—*Fresh pelage:* Upperparts mouse gray, mixed with blackish on median dorsal area, thinly grizzled with ochraceous buffy hairs; underparts and feet white; lateral line pale ochraceous buff, extending from cheeks to hind legs; outer sides of forelegs grayish, interrupted by a white area below lateral line; ears dusky, faintly edged with whitish; tail brownish above, white below.

Cranial characters.—Skull broad, flat, and rather short. Similar in general to that of *alleni*, but interparietal much smaller, subtriangular instead of oval, the anterior angle well developed; braincase less arched; nasals slightly broader posteriorly, concave instead of truncate. Differs from *jalicensis* in the same general characters as from *alleni*, in addition to larger size.

Measurements.—Type (from original description): Head and body, 114; tail, 120; hind foot (without claws), 28.5. An adult topotype: Total length, 250; tail vertebræ, 128; hind foot, 32. *Skull* (an adult topotype): Greatest length, 33.5; zygomatic breadth, 16; interorbital breadth, 8.6; length of nasals, 14.3; width of braincase, 14.8; alveolar length of upper molar series, 5.5.

Remarks.—A topotype of *bulleri* in the collection of the Biological Survey has been found by Mr. Gerrit S. Miller, jr., to agree very closely with the type in the British Museum. *L. bulleri* is clearly a member of the *irroratus* group. In external appearance it resembles *alleni* and *jalicensis*, but the cranial characters, especially the decidedly smaller size and more triangular shape of the interparietal, distinguish it from either.

Specimens examined:

Jalisco: La Laguna (type locality), 1.

LIOMYS GUERRERENSIS sp. nov.

GUERRERO SPINY POCKET MOUSE.

Type from Omilteme, Guerrero, Mexico. No. 127523, ♀ young, U. S. National Museum (Biological Survey collection), collected by Nelson and Goldman, May 17, 1903. Original No. 16435.

Distribution.—Humid heavily forested Pacific slopes of the Sierra Madre in the vicinity of the type locality. Humid Tropical Zone.

General characters.—Size large; tail about equal to head and body; color blackish; lateral line very faint; hind foot five-tuberculate. Similar in general to *irroratus*, but much darker, and cranial characters quite different.

Color.—Type (acquiring adult pelage): Top of head and back fresh deep glossy black, thinly grizzled with buffy hairs; sides of body and hind legs still in immature mouse gray pelage; underparts and feet white; outer sides of forelegs grayish, interrupted along lateral line; heels, inner sides of ankles, and hairy portion of sole of hind foot dark brownish black; ears black, edged with whitish; tail black above, white below, except extreme tip, which is dark all round.

Cranial characters.—Skull massive, short and broad, with short, heavy rostrum, broad frontal region, narrow palate, and heavy dentition. Compared with *irroratus*, the skull is heavier; rostrum shorter and much broader, especially posteriorly, broadening more gradually to zygomata; nasals shorter, slightly notched posteriorly; premaxillæ broader, reaching posteriorly beyond nasals; maxillary root of zygoma heavier; frontals broader; interparietal broadly pentagonal (oval in *irroratus*); palate narrower; dentition of the *irroratus* type, but heavier.

Measurements.—Type: Total length, 255; tail vertebræ, 127; hind foot, 34. An immature topotype: 247; 140; 35. *Skull* (average of two immature topotypes): Greatest length, 33.2 (33.2–33.3); zygomatic breadth, 16 (15.6–16.5); interorbital breadth, 8.5 (8.5–8.6); length of nasals, 13.1 (13–13.2); width of braincase, 15.4 (15–15.9); alveolar length of upper molar series, 5.8 (5.7–5.9).

Remarks.—*L. guerrerensis* is a member of the *irroratus* group, but appears to be a distinct species. The only known specimens are immature, but differ strikingly from *irroratus* of the same age, and the differences noted would doubtless be accentuated in adults. The unusually dark color of the species is probably due to a heavy forest environment.

Specimens examined:

Guerrero: Omilteme (type locality), 2.

PLATE I.

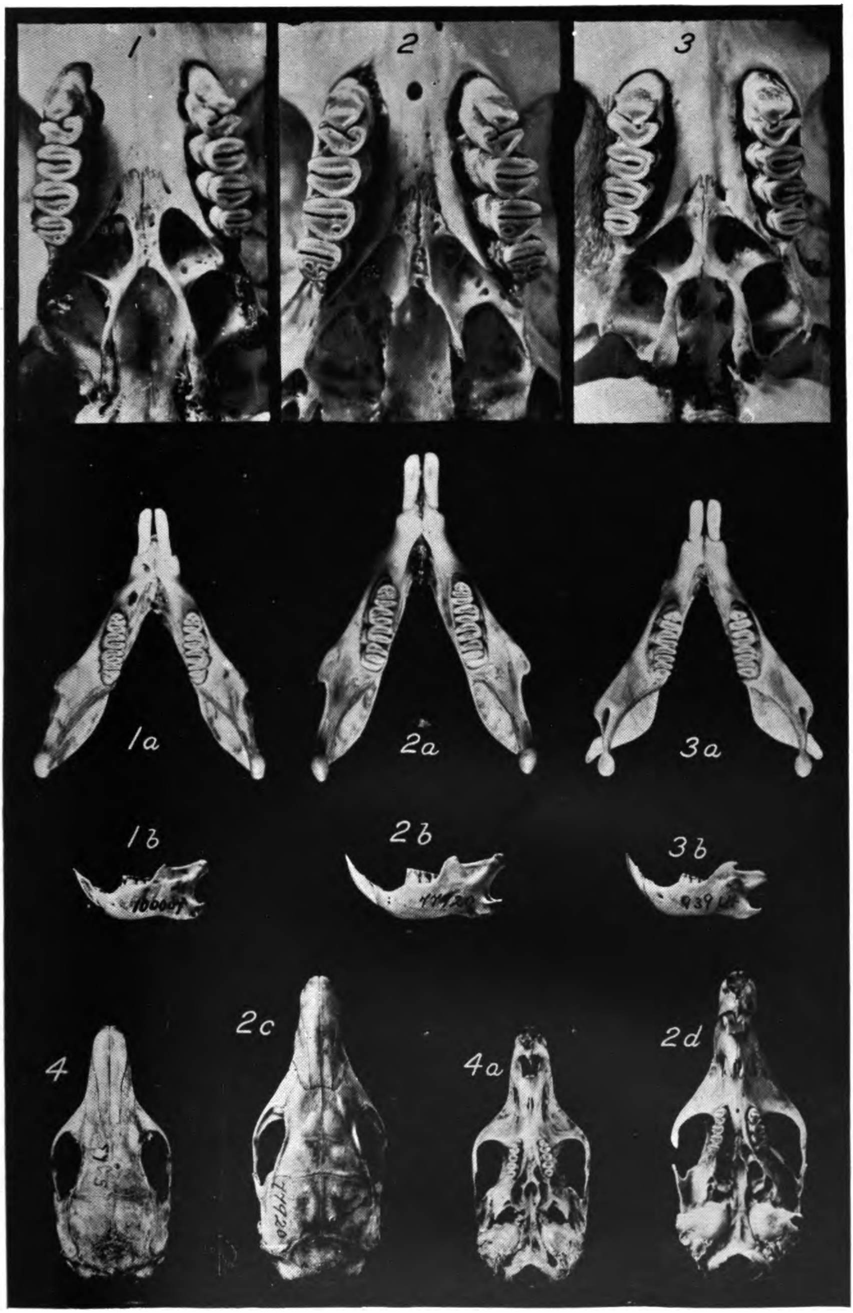
[Natural size, except figs. 1, 2, and 3, which are enlarged four diameters, and figs. 1*a*, 2*a*, and 3*a*, which are enlarged two diameters.]

FIGS. 1, 1*a*, 1*b*. *Heteromys* (*Heteromys*) *desmarestianus* Gray.
- 1. Partially worn crowns of upper molars. (No. 100007, U. S. Nat. Mus., Biological Survey Coll.)
- 1*a*. Jaw with partially worn molars. (No. 100007, U. S. Nat. Mus., Biological Survey Coll.)
- 1*b*. Lateral view of jaw. (No. 100007, U. S. Nat. Mus., Biological Survey Coll.)

2, 2*a*–2*d*. *Heteromys* (*Xylomys*) *nelsoni* Merriam.
- 2. Partially worn crowns of upper molars. (No. 77920, U. S. Nat. Mus., Biological Survey Coll.; type.)
- 2*a*. Jaw with partially worn molars. (No. 77920, U. S. Nat. Mus., Biological Survey Coll.; type.)
- 2*b*. Lateral view of jaw. (No. 77920, U. S. Nat. Mus., Biological Survey Coll.; type.)
- 2*c*. Upper view of skull. (No. 77920, U. S. Nat. Mus., Biological Survey Coll.; type.)
- 2*d*. Lower view of skull. (No. 77920, U. S. Nat. Mus., Biological Survey Coll.; type.)

3, 3*a*, 3*b*. *Liomys irroratus alleni* (Coues).
- 3. Partially worn crowns of upper molars. (No. 93914, U. S. Nat. Mus., Biological Survey Coll.)
- 3*a*. Jaw with partially worn molars. (No. 93914, U. S. Nat. Mus., Biological Survey Coll.)
- 3*b*. Lateral view of jaw. (No. 93914, U. S. Nat. Mus., Biological Survey Coll.)

4, 4*a*. *Heteromys* (*Heteromys*) *anomalus* (Thompson). Caura, Island of Trinidad. Adult male. (No. 5965, Amer. Mus. Nat. Hist.)



SKULLS AND JAWS OF HETEROMYS AND LIOMYS.

1, 1*a*, 1*b*. H. desmarestianus.
2, 2*a*, 2*b*, 2*c*, 2*d*. H. nelsoni.
3, 3*a*, 3*b*. L. i. alleni.
4, 4*a*. H. anomalus.

PLATE II.

[Natural size.]

Figs. 1, 1*a*. *Heteromys jesupi* Allen. Type. Near Minca, Colombia. Adult female. (No. 15347, Amer. Mus. Nat. Hist.)

2, 2*a*. *Heteromys australis* Thomas. Topotype. San Javier, Ecuador. Adult male. (No. 113306, U. S. Nat. Mus.)

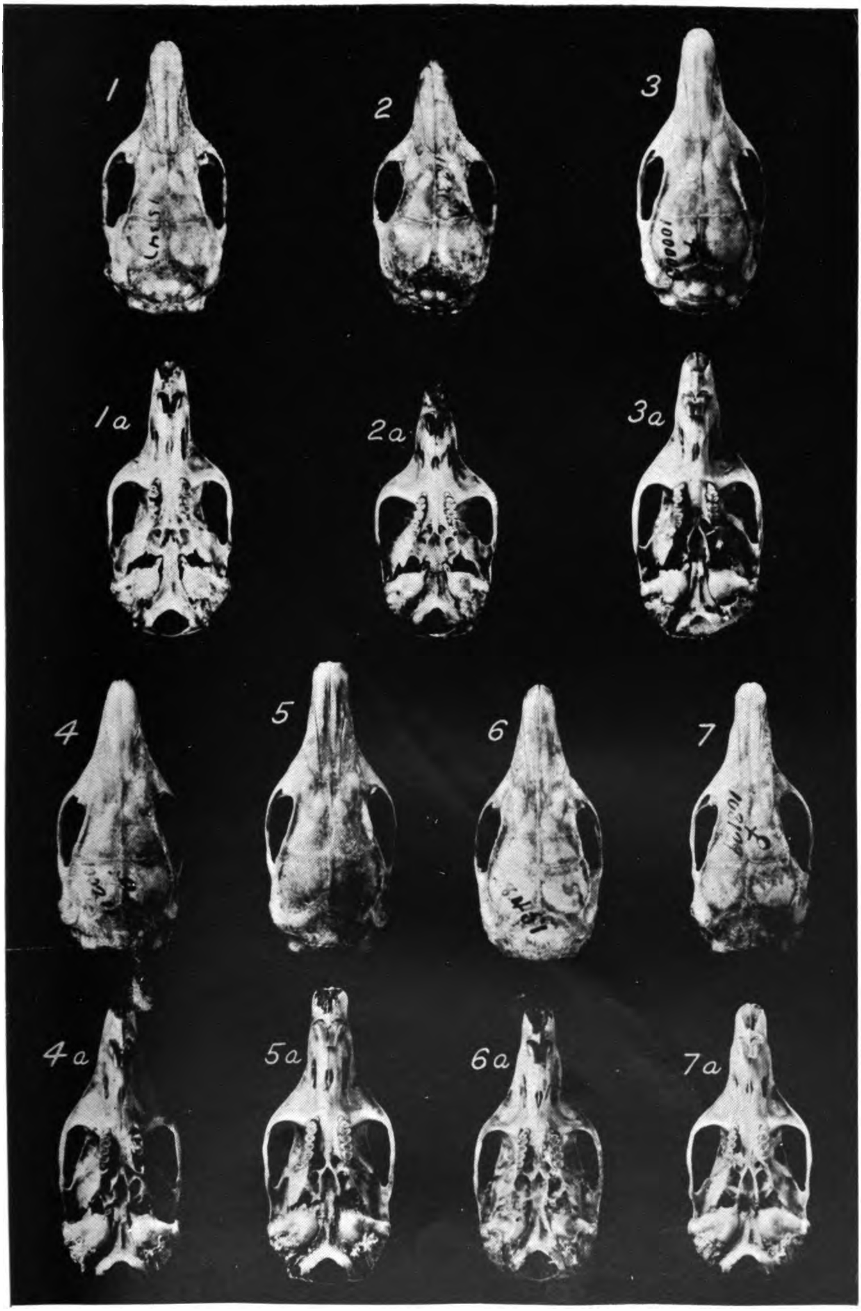
3, 3*a*. *Heteromys desmarestianus* Gray. Teapa, Tabasco, Mexico. Adult female. (No. 100003, U. S. Nat. Mus., Biological Survey Coll.)

4, 4*a*. *Heteromys longicaudatus* Gray. Montecristo, Tabasco, Mexico. Adult female. (No. 100211, U. S. Nat. Mus., Biological Survey Coll.)

5, 5*a*. *Heteromys goldmani* Merriam. Type. Chicharras, Chiapas, Mexico. Adult male. (No. 77576, U. S. Nat. Mus., Biological Survey Coll.)

6, 6*a*. *Heteromys fuscatus* Allen. Type. Tuma, Nicaragua. Adult male. (No. 28451, Amer. Mus. Nat. Hist.)

7, 7*a*. *Heteromys gaumeri* Allen and Chapman. Tunkas, Yucatan. Adult female. (No. 108129, U. S. Nat. Mus., Biological Survey Coll.)



SKULLS OF HETEROMYS.

1, 1*a*. H. jesupi.
2, 2*a*. H. australis.
3, 3*a*. H. desmarestianus.
4, 4*a*. H. longicaudatus.
5, 5*a*. H. goldmani.
6, 6*a*. H. fuscatus.
7. 7*a*. H. gaumeri.

PLATE III.

[Natural size.]

FIGS. 1, 1*a*. *Liomys pictus* (Thomas). Armeria, Colima, Mexico. Adult male. (No. 45371, U. S. Nat. Mus., Biological Survey Coll.)

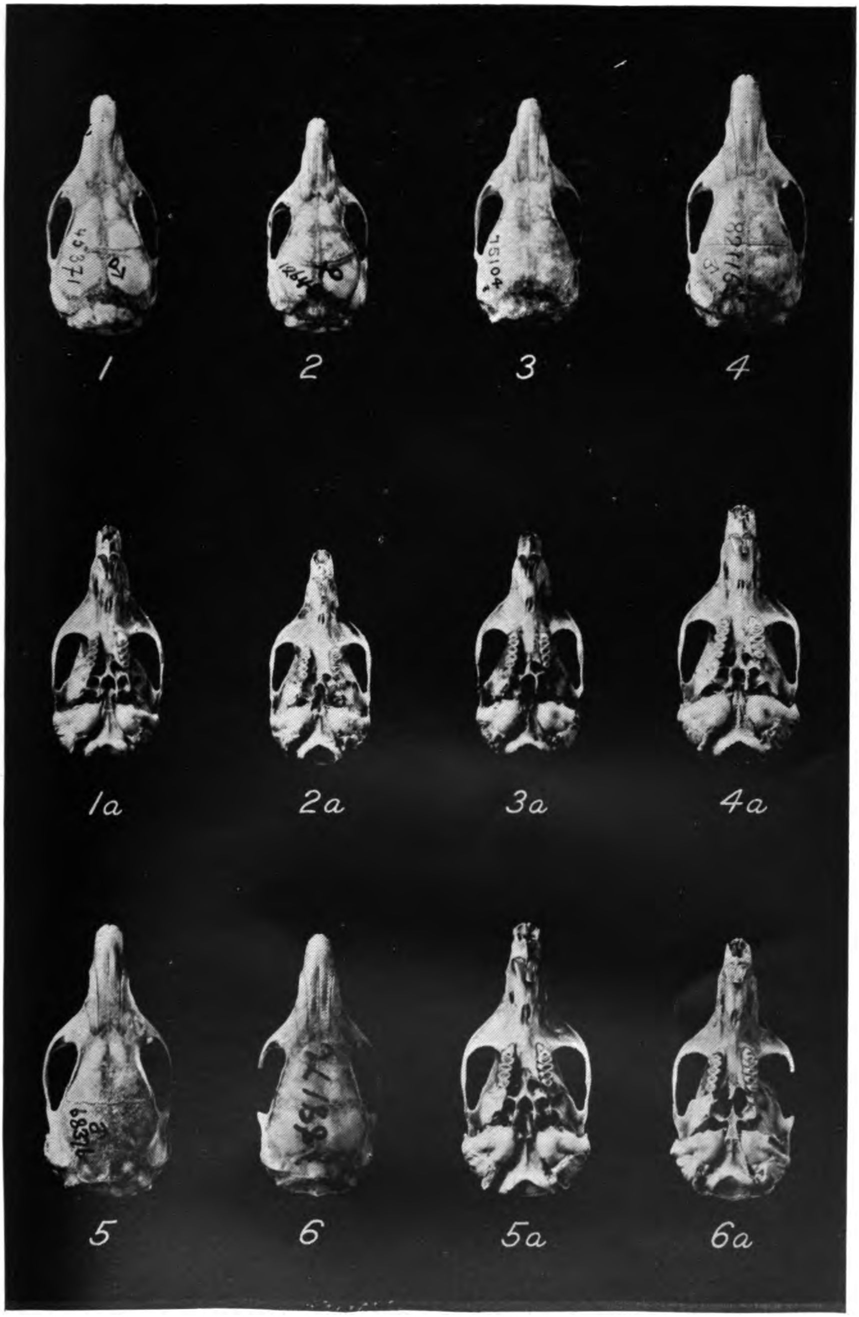
2, 2*a*. *Liomys pictus parviceps* Goldman. Topotype. La Salada, Michoacan, Mexico. Adult male. (No. 126481, U. S. Nat. Mus., Biological Survey Coll.)

3, 3*a*. *Liomys crispus* Merriam. Topotype. Tonala, Chiapas, Mexico. Adult male. (No. 75104, U. S. Nat. Mus., Biological Survey Coll.)

4, 4*a*. *Liomys irroratus alleni* (Coues). Topotype. Rio Verde, San Luis Potosi, Mexico. Adult male. (No. 82116, U. S. Nat. Mus., Biological Survey Coll.)

5, 5*a*. *Liomys irroratus* (Gray). Oaxaca, Oaxaca, Mexico. Adult male. (No. 68376, U. S. Nat. Mus., Biological Survey Coll.)

6, 6*a*. *Liomys bulleri* (Thomas). Topotype. La Laguna, Sierra de Juanacatlan, Jalisco, Mexico. Adult female. (No. 88176, U. S. Nat. Mus., Biological Survey Coll.)



SKULLS OF LIOMYS.

1, 1*a*. L. pictus.
2, 2*a*. L. p. parviceps.
3, 3*a*. L. crispus.
4, 4*a*. L. i. alleni.
5, 5*a*. L. irroratus.
6, 6*a*. L. bulleri.

INDEX.

[New species in **bold-faced type;** synonyms in *italics;* pages containing the principal reference to a species in **bold-faced figures.**]

adspersus, *Heteromys*, 51.
Liomys, **51–52.**
albolimbatus, *Heteromys*, 53.
alleni, *Heteromys*, 32, 56.
Liomys irroratus, **56–57.**
annectens, *Heteromys*, 45.
Liomys, **45.**
anomalus, *Cricetus*, 8, 16.
Heteromys, 8, **16–17.**
Mus, 7, 8, 16.
australis, Heteromys, **18–19.**
bicolor, Heteromys **19–20.**
Perognathus, 19.
bulleri, *Heteromys*, 61.
Liomys, **61–62.**
canus, Liomys irroratus, **60.**
Cricetus anomalus, 8, 16.
crispus, Liomys, **46–47.**
setosus, Liomys, **47–48.**
Dasynotus, 14.
desmarestiana, *Heteromys*, 8.
desmarestianus, Heteromys, **20–22.**
griseus, Heteromys, **22–23.**
Dipodomys, 7.
esquinapæ, *Heteromys*, 35.
Liomys pictus, **35–36.**
exiguus, *Heteromys*, 55.
fuscatus, Heteromys, **28–29.**
gaumeri, Heteromys, **29–30.**
goldmani, Heteromys, **24–25.**
griseus, Heteromys desmarestianus, **22–23.**
guerrerensis, Liomys, 62–63.
Heteromys, genus, 14.
subgenus, 15.
Heteromys adspersus, 51.
albolimbatus, 53.
alleni, 32, 56.
annectens, 45.
anomalus, 8, **16–17.**
australis, **18–19.**
bicolor, **19–20.**
bulleri, 61.
desmarestiana, 8.
desmarestianus, **20–22.**
desmarestianus griseus, **22–23.**
esquinapæ, 35.
exiguus, 55.
fuscatus, **28–29.**
gaumeri, **29–30.**
goldmani, **24–25.**
hispidus, 33.
irroratus, 53.
jalicensis, 60.
jesupi, **18.**
Heteromys lepturus, **25–26.**
longicaudatus, **23–24.**
melanoleucus, 16.
nelsoni, 30, **31–32.**
paralius, 44, 45.
pictus, 33.
repens, **27–28.**
salvini, 50.
salvini nigrescens, 51.
temporalis, 26–27.
thompsonii, 8, 16.
vulcani, 48.
heterothrix, Liomys, **49–50.**
hispidus, *Heteromys*, 33.
Hystrix, 8.
irroratus alleni, Liomys, **56–57.**
canus, Liomys, **60.**
Heteromys, 53.
jalicensis, Liomys, **60–61.**
Liomys, **53–54.**
minor, Liomys, **56.**
pretiosus, Liomys, 58.
texensis, Liomys, **59.**
torridus, Liomys, **55.**
isthmius, Liomys pictus, **41–42.**
jalicensis, *Heteromys*, 60.
Liomys irroratus, **60–61.**
jesupi, Heteromys, **18.**
Key to genera and subgenera, 12.
Key to species and subspecies, 12.
lepturus, Heteromys, **25–26.**
Liomys, genus, **32–33.**
Liomys adspersus, **51–52.**
annectens, **45.**
bulleri, **61–62.**
crispus, **46–47.**
crispus setosus, **47–48.**
guerrerensis, 62–63.
heterothrix, **49–50.**
irroratus, **53–54.**
irroratus alleni, **56–57.**
irroratus canus, **60.**
irroratus jalicensis, **60–61.**
irroratus minor, **56.**
irroratus pretiosus, 58.
irroratus texensis, **59.**
irroratus torridus, **55.**
orbitalis, 42, 43.
phæura, 40.
pictus, **33–35.**
pictus esquinapæ, **35–36.**
pictus isthmius, **41–42.**
pictus obscurus, **44–45.**
pictus parviceps, **38–39.**

Liomys pictus phæurus, **40–41.**
        pictus plantinarensis, **37–38.**
        pictus rostratus, **39–40.**
        pictus sonorana, **36–37.**
        pictus veræcrucis, **42–43.**
        salvini, **50–51.**
        salvini nigrescens, **51.**
        vulcani, **48–49.**
longicaudatus, Heteromys, **23–24.**
Melanoleucus, Heteromys, 16.
Microdipodops, 7.
minor, Liomys irroratus, **56.**
mouse, spiny pocket, Allen, **56–57.**
        bicolored, **19–20.**
        black, **51.**
        Buller, **61–62.**
        Carrizal, **44–45.**
        Chihuahua, **60.**
        Chiriqui, **27–28.**
        Coban, **20–22.**
        dusky-tailed, **40–41.**
        Esquinapa, **35–36.**
        Gaumer, **29–30.**
        Goldman, **24–25.**
        gray, **22–23.**
        Guerrero, **62–63.**
        habits, **8–9.**
        Honduras, **49–50.**
        Huajuapam, **56.**
        Huehuetan, **47–48.**
        Isthmian, **41–42.**
        Jalisco, **60–61.**
        Jesup, **18.**
        La Salada, **38–39.**
        long-tailed, **23–24.**
        Metlaltoyuca, **58.**
        Motzorongo, **26–27.**
        Nelson, **31–32.**
        Nicaragua, **28–29.**
        Oaxaca, **53–54.**
        Ometepec, **39–40.**
        painted, **33–35.**
        Panama, **51–52.**
        Plantinar, **37–38.**
        Pluma, **45.**
        Salvin, **50–51.**
        Santo Domingo, **25–26.**
        Sonora, **36–37.**
        southern, **18–19.**
        Texas, **59.**
        Tonala, **46–47.**
mouse, spiny pocket, torrid, **55.**
        Trinidad, **16–17.**
        Vera Cruz, **42–43.**
        Volcan, **48–49.**
Mus, 8.
Mus anomalus, 7, 8, 16.
nelsoni, Heteromys, 30, **31–32.**
nigrescens, Heteromys salvini, 51.
        Liomys salvini, **51.**
obscurus, Liomys pictus, **44–45.**
orbitalis, Liomys, 42, 43.
paralius, Heteromys, 44, 45.
parviceps, Liomys pictus, **38–39.**
Perodipus, 7.
Perognathus, 7.
Perognathus bicolor, 19.
phæura, Liomys, 40.
phæurus, Liomys pictus, **40–41.**
pictus esquinapæ, Liomys, **35–36.**
        Heteromys, 33.
        isthmius, Liomys, **41–42.**
        Liomys, **33–35.**
        obscurus, Liomys, **44–45.**
        parviceps, Liomys, **38–39.**
        phæurus, Liomys, **40–41.**
        plantinarensis, Liomys, **37–38.**
        rostratus, Liomys, **39–40.**
        sonorana, Liomys, **36–37.**
        veræcrucis, Liomys, **42–43.**
plantinarensis, Liomys pictus, **37–38.**
pocket mouse, spiny. (*See* mouse, spiny pocket.)
pretiosus, Liomys irroratus, 58.
repens, Heteromys, **27–28.**
rostratus, Liomys pictus, **39–40.**
Saccomys, 14.
salvini, Heteromys, 50.
        Liomys, **50–51.**
        nigrescens, Liomys, **51.**
setosus, Liomys crispus, **47–48.**
sonorana, Liomys pictus, **36–37.**
Species and subspecies, list of, 11.
temporalis, Heteromys, 26–27.
texensis, Liomys irroratus, **59.**
thompsonii, Heteromys, 8, 16.
torridus, Liomys irroratus, **55.**
type localities, list of, 11.
veræcrucis, Liomys pictus, **42–43.**
vulcani, Heteromys, 48.
        Liomys, **48–49.**
Xylomys, subgenus, 8, **30–31.**

○

14 DAY USE
RETURN TO DESK FROM WHICH BORROWED
EARTH SCIENCES LIBRARY

EARTH SCIENCES LIBRARY

This book is due on the last date stamped below, or
on the date to which renewed.
Renewed books are subject to immediate recall.

LD 21-50m-4,'63
(D6471s10)476

General Library
University of California
Berkeley